

**NASA GLENN RESEARCH CENTER**  
AT LEWIS FIELD AND PLUM BROOK STATION

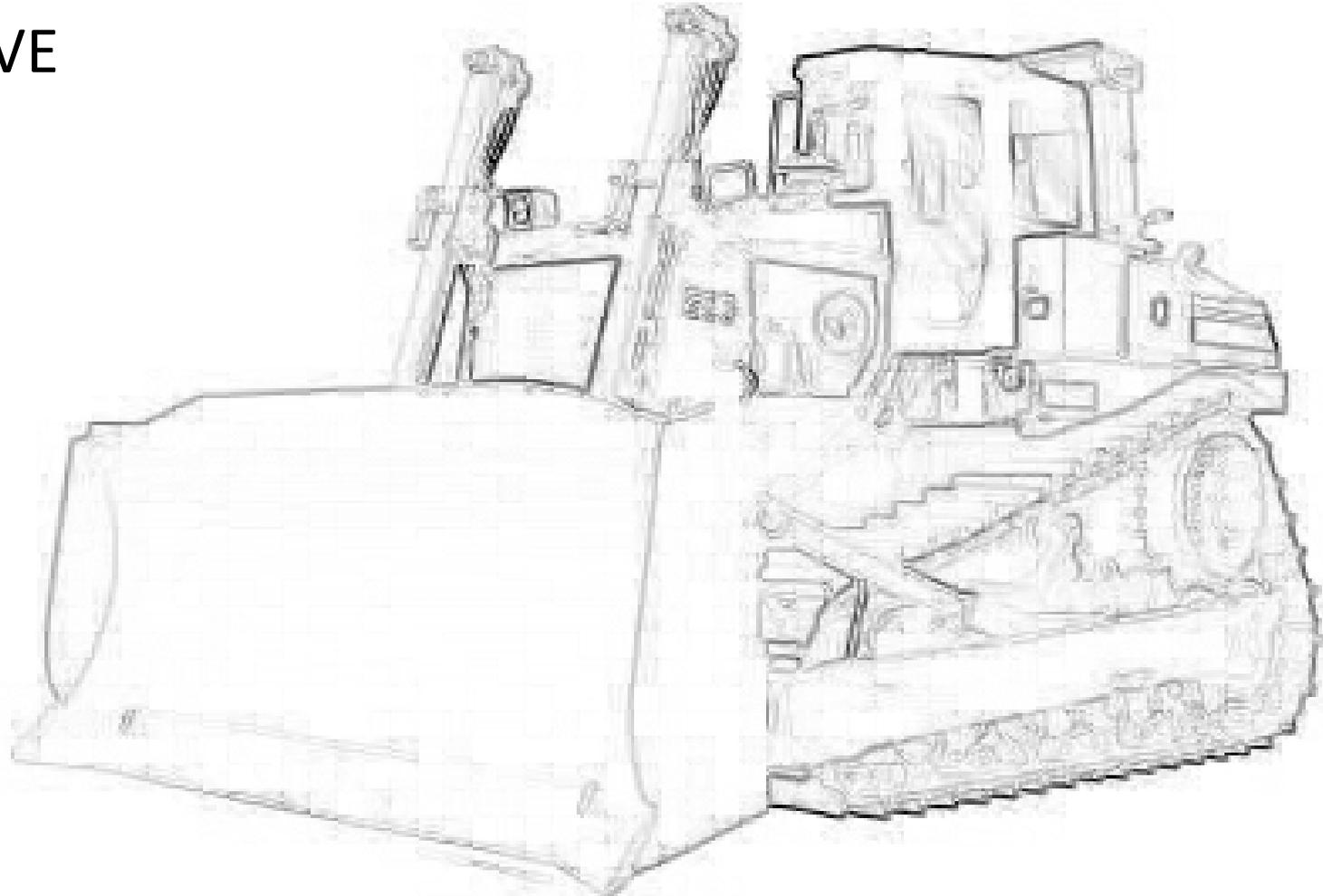
CIVIL SYSTEMS  
PRESENTS

# **EXCAVATION 101**

# EXCAVATION 101

## SYLLABUS

- DESCRIPTION
- OBJECTIVE
- TOPICS



# EXCAVATION 101 - SYLLABUS

- TOPICS

- Excavation at GRC
- GRC Excavation Permit
- Competent Person
- The Markings
- Excavation Tolerance Zone
- Reading the Underground Record Drawings

# EXCAVATION 101 - SYLLABUS

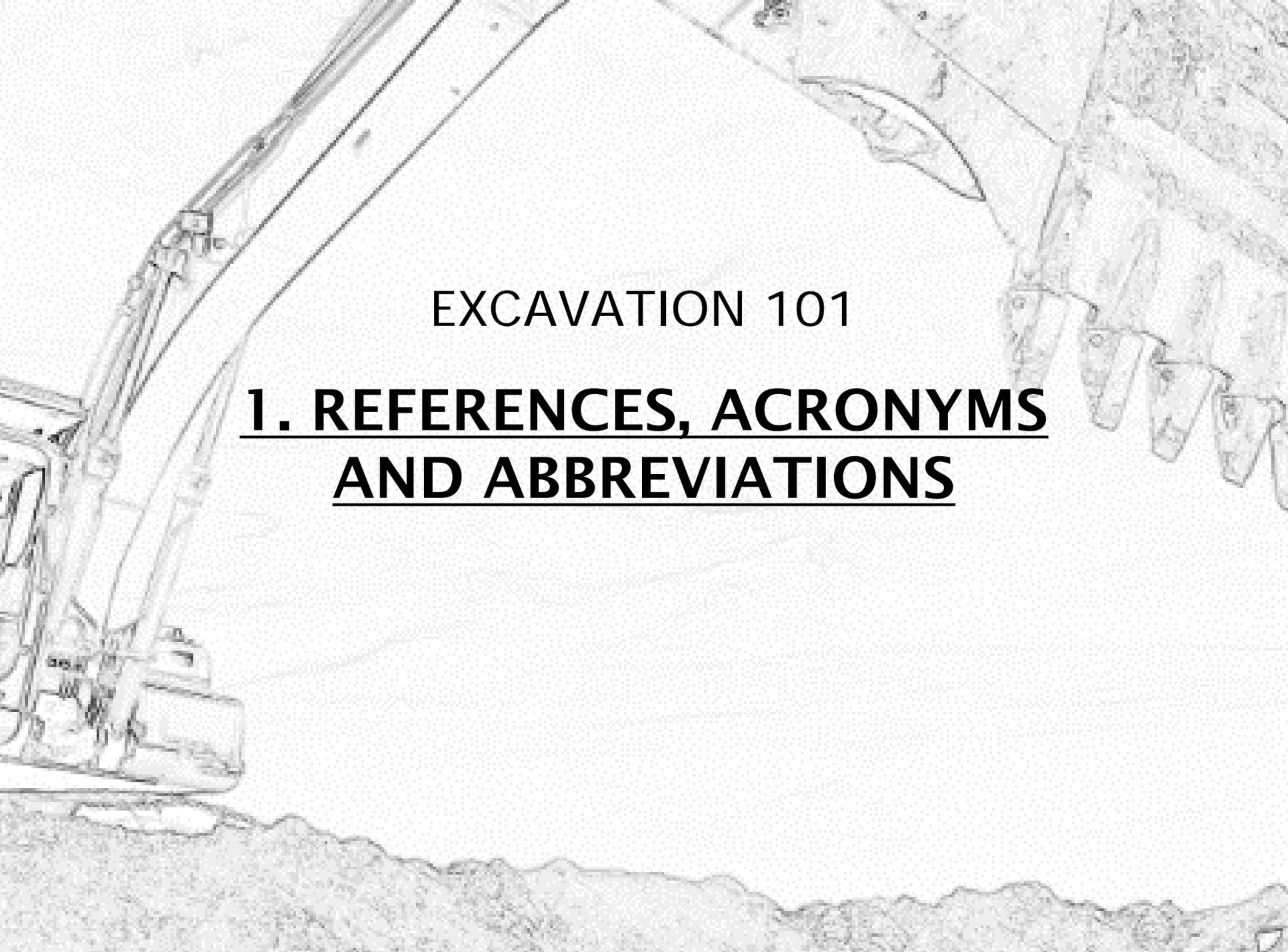
- OBJECTIVE

- To ensure the safety of workers or visitors in or around excavation activities or ground penetration activities performed at the Glenn Research Center
- ...Excavation and trenching are among the most hazardous construction operations
- ...There are approximately **24 underground utility systems** at GRC. This has caused potentially serious situations during construction and maintenance activities
- ...It is GRC's policy to evaluate all excavation and ground penetration activities to minimize the potential of cave-ins, environmental contamination, underground utility damage, or contact with subsurface encumbrances..."
- This is intended as a **summary** of basic requirements and is **not a substitute** for full understanding of the requirements set forth in **OSHA Standard 29 CFR 1926.651**.

# EXCAVATION 101 - SYLLABUS

## • ORGANIZATION

1. References, Acronyms and Abbreviations
2. Excavation at GRC
3. GRC Excavation Permit
  - Excavation Permit Work Area
  - Permit Part A
  - Permit Part B
  - Permit Part C
4. Competent Person
  - Excavation Competent Person
  - Excavation & Utility Competent Person
5. The Markings
  - NASA GRC Marking Standards
  - Table of Colors and Abbreviations
  - White Lining - Contractor Markings
  - Utility Markings – Locator Markings
  - Excavation Tolerance Zone
  - Undocumented Conditions
  - Emergency Repairs
6. Reading the Underground Record Drawings
  - Reading the URDs – Abbreviations
  - Reading the URDs – Drawing Symbols
  - Reading the URDs – Typical Details

The background of the slide is a grayscale, halftone-style image of an excavator bucket. The bucket is shown from a side-on perspective, with its teeth pointing downwards and to the right. The image is composed of a grid of small dots, giving it a textured appearance. The bucket is positioned in the upper half of the frame, with its handle and boom extending towards the top left corner.

## EXCAVATION 101

# 1. REFERENCES, ACRONYMS AND ABBREVIATIONS

# EXCAVATION 101

- REFERENCES, ACRONYMS AND ABBREVIATIONS

References used in this discussion include:

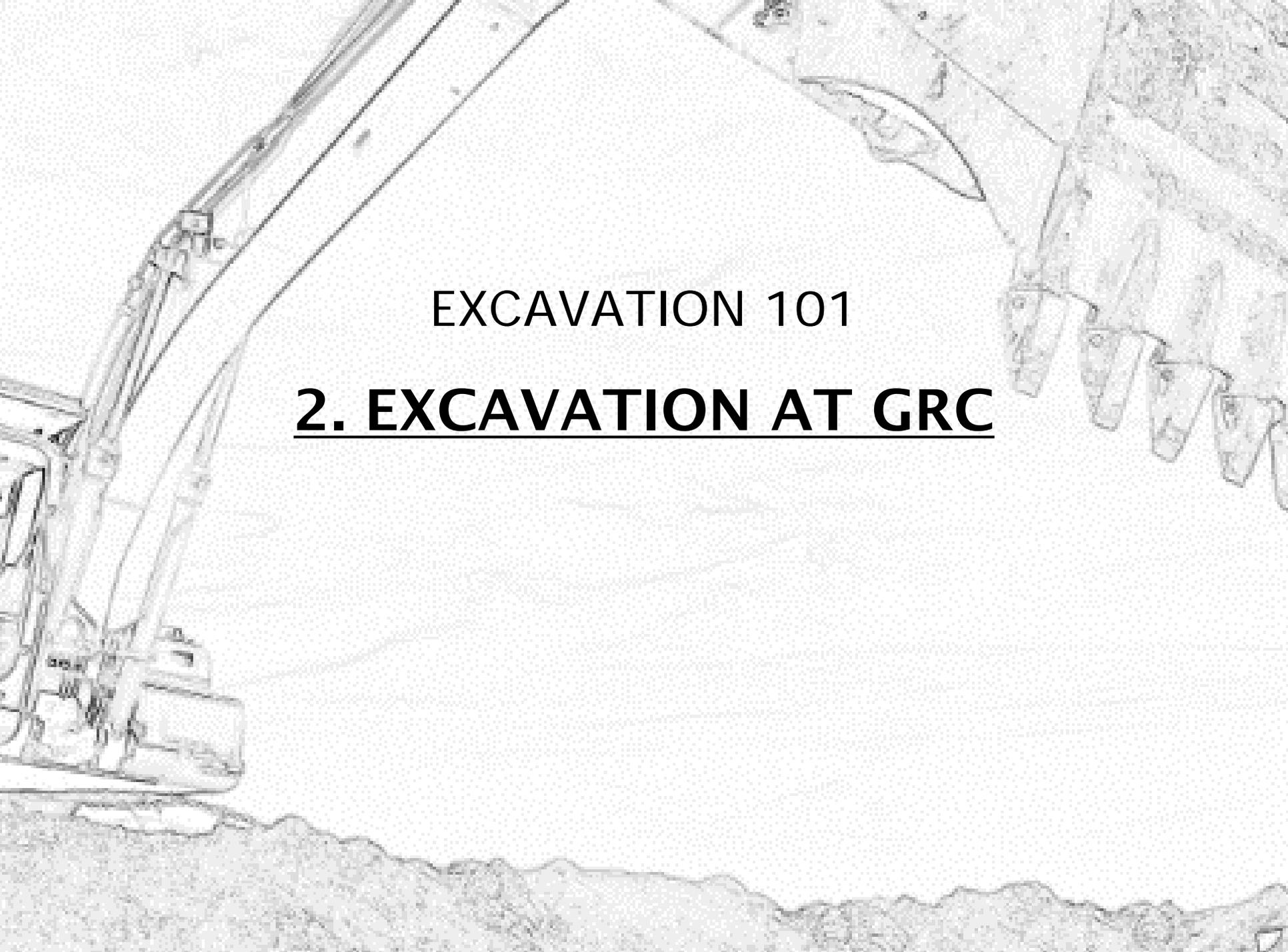
- [Ohio Revised Code](#) (ORC) 153.64
- [Ohio Revised Code](#) (ORC) 3781.25-3781.32
- [OSHA Standard 29 CFR 1926](#) Subpart P
- [Ohio Utilities Protection Service](#)
- [Glenn Safety Manual](#), Chapter 35-Digging, Trenching and Excavating
- [Excavation Permit](#) NASA Form GRC927
- NASA Survey and Utility Location Service
- NASA Contract Drawings and Specifications that govern the execution of the work
- NASA Underground Record Drawings (URDs)

# EXCAVATION 101

- REFERENCES, ACRONYMS AND ABBREVIATIONS

Acronyms and Abbreviations used in this discussion:

APWA.....	American Public Works Association
COR.....	Contracting Officer's Representative
FE.....	Energy and Environmental Management Office
FOS .....	Facility Operations Specialist
GRC.....	Glenn Research Center
ORC.....	Ohio Revised Code
POC.....	Point of Contact
SHeD.....	Safety and Health Division
SSC .....	Support Services Contractor
URD.....	Underground Record Drawing
OUPS .....	Ohio Utilities Protection Service



EXCAVATION 101

**2. EXCAVATION AT GRC**

# EXCAVATION 101

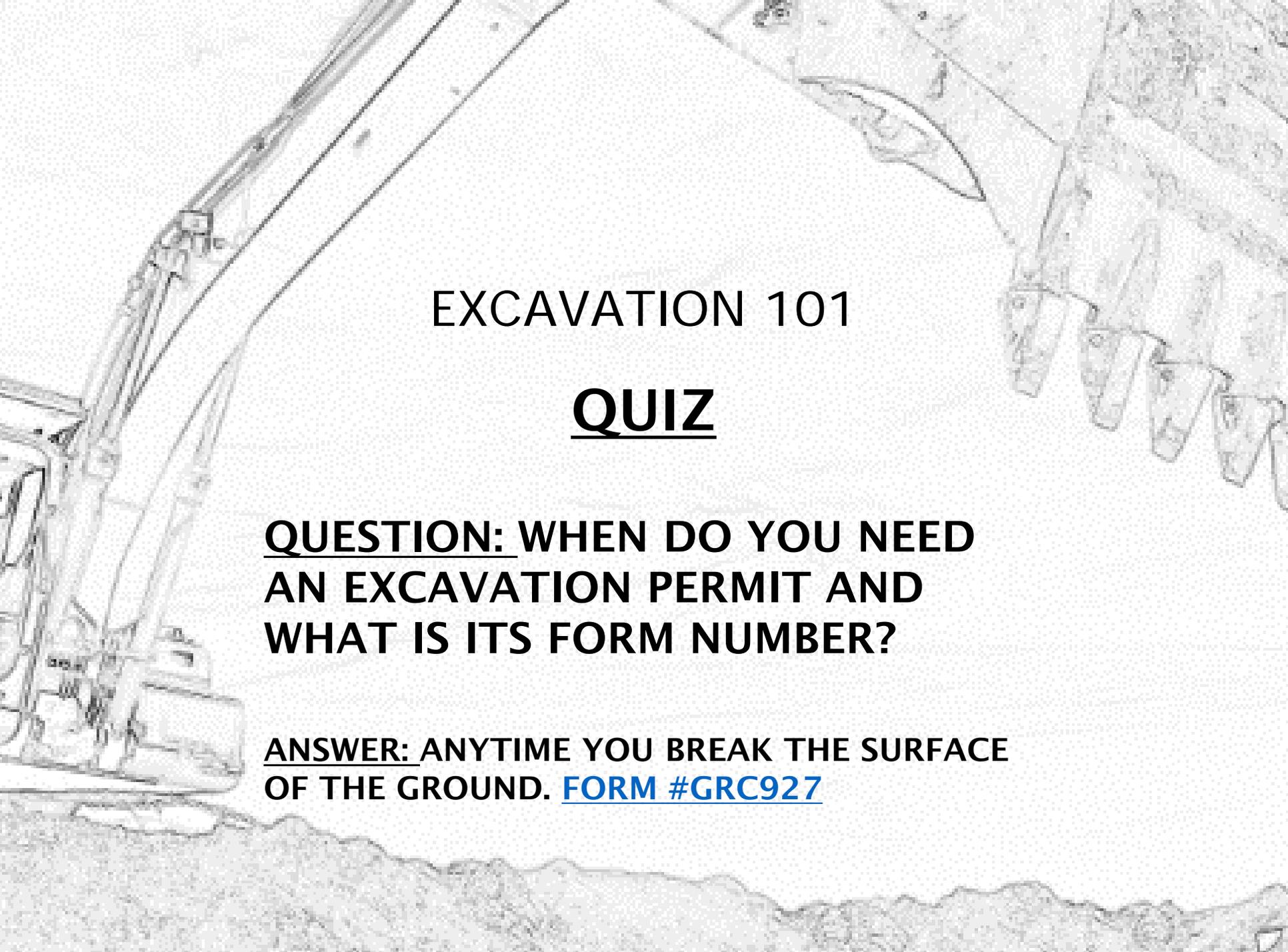
- EXCAVATION AT GRC

[OHIO REVISED CODE 3781.25:](#)

“Excavation means the use of hand tools, powered equipment or explosives to move earth, rock or other materials in order to penetrate or bore or drill into the earth, or to demolish any structure whether or not it is intended that the demolition will disturb the earth...”

**NO EXCAVATION OF ANY DEPTH SHALL  
COMMENCE WITHOUT A COMPLETE PERMIT**

Breaking the surface is considered an excavation at GRC.

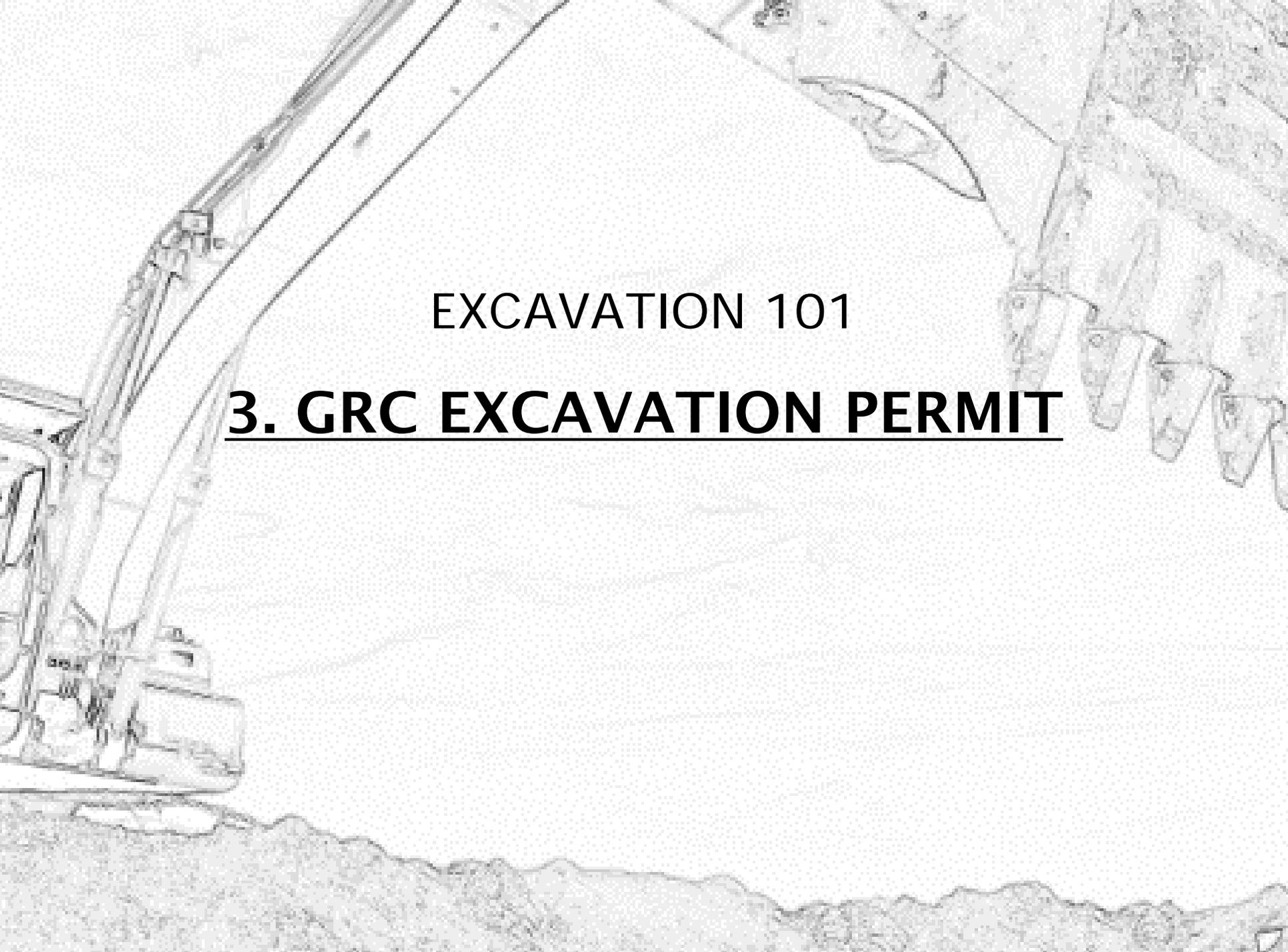
The background of the slide is a grayscale, halftone-style image of an excavator bucket. The bucket is shown from a top-down perspective, with its teeth pointing downwards. The image is slightly faded and serves as a backdrop for the text.

# EXCAVATION 101

## QUIZ

**QUESTION: WHEN DO YOU NEED AN EXCAVATION PERMIT AND WHAT IS ITS FORM NUMBER?**

**ANSWER: ANYTIME YOU BREAK THE SURFACE OF THE GROUND. [FORM #GRC927](#)**



EXCAVATION 101

**3. GRC EXCAVATION PERMIT**

# EXCAVATION 101

- GRC EXCAVATION PERMIT

A FULLY EXECUTED NASA FORM GRC927,

“EXCAVATION PERMIT”

IS REQUIRED PRIOR TO PERFORMING

ANY EXCAVATION ACTIVITY AT THE

NASA GLENN RESEARCH CENTER!



# EXCAVATION 101

- GRC EXCAVATION PERMIT
  - PERMIT PART A
    - Step 1 - NASA/SSC Initiator
    - Step 2 - Soil Characteristics
    - Step 3 - SHeD Notification
    - Step 4 - NASA Surveyor
    - Step 5 – Excavation and Infrastructure Approval

(NASA SIGNOFF IS DIGITAL-PDF ONLY)

National Aeronautics and Space Administration		Excavation Permit	Civil Systems Use Only Permit Expiration Date
<b>PART A</b>			
<b>Step 1. NASA/SSC Initiator (NOTE: Provide 48 hours advance notice to surveyors prior to marking.)</b>			
NASA/SSC Initiator	Telephone number	Date	
Contract number/Project title			
Prime Contractor		Telephone number	
Excavation Contractor		Telephone number	
Contractor Excavation competent person		Telephone number	
Project scope and limits			
Work area defined: (Work area limited approximately 400 linear feet or 400' x 110' area)			
LF	Area	Depth	
NOTE: The contractor must mark the center line of new utility installed with appropriate stakes and color in area project segment and excavation limits with white paint. Contractor to also submit marked up drawing.			
Excavation dates: Projected start =		Finish =	NOTE: Permit valid 3 months after final signature.
Click on the button to electronically submit the permit.			<b>SUBMIT</b>
<b>Step 2. GRC Soil Coordinator</b>			
GRC Soil Coordinator shall assess soil conditions for contaminants in designated excavation area/segment. The completed Soil Determination Checklist, GRC133, shall be attached to the GRC 927.			
Notes:			
GRC Soil Coordinator:		Date:	
<b>Step 3. Safety and Health Division (SHeD)</b>			
<b>SHeD Evaluation:</b>			
SHeD shall perform a preliminary confined space determination and verify excavation process being adhered too.			
Notes:			
<input type="checkbox"/> GRC 199, Confined Space Entry Permit is required.			
SHeD Determination:		Date:	
<b>Step 4. NASA Surveyor</b>			
<b>Excavation Identification/Marking:</b>			
The NASA Surveyor shall mark the location of any existing utility line that may be encountered during excavation. The NASA contact shall coordinate all interfaces between the contractor and the NASA Surveyor.			
Notes:			
The contractor must contact OUPS at 1-800-362-2764 or 811: <input type="checkbox"/> Yes <input type="checkbox"/> Not applicable			
Surveyor:		Date:	
<b>Step 5. Excavation and Infrastructure Approval</b>			
The NASA/SSC initiator must acquire an area clearance. <input type="checkbox"/> Yes <input type="checkbox"/> Not applicable			
Comments:			
System Manager (For the utility being installed):		Telephone number:	Date:
Civil System Manager:		Telephone number:	Date:
Permit is valid for 3 months after step 5 is complete or until work is complete, whatever is more stringent. Proceed to use Part B, (Non-maintenance projects.)			
GRC 927 06/14 (1.0)		PREVIOUS EDITIONS ARE OBSOLETE	
		Page 1 of 4	

# EXCAVATION 101

- GRC EXCAVATION PERMIT

- PERMIT PART A

- Step 1 - NASA/SSC Initiator
- Fillable .pdf form
- Fill out all fields
- Filled form can be saved

**Excavation Permit**

Step 1. NASA/SSC Initiator (NOTE: Provide 48 hours advance notice to surveyors prior to marking.)

NASA/SSC Initiator	Telephone number	Date
Contract number/Project title		
Prime Contractor	Telephone number:	
Excavation Contractor	Telephone number:	
Contractor Excavation competent person	Telephone number	

Project scope and limits

Work area defined: (Work area limited approximately 400 linear feet or 400' x 110' area)  
 LF \_\_\_\_\_ Area \_\_\_\_\_ Depth \_\_\_\_\_

NOTE: The contractor must mark the center line of new utility installed with appropriate stakes and color in area project segment and excavation limits with white paint. Contractor to also submit marked up drawing.

Excavation dates: Projected start = \_\_\_\_\_ Finish = \_\_\_\_\_ NOTE: Permit valid 3 months after final signature.

Click on the button to electronically submit the permit.

Step 2. GRC Soil Coordinator

GRC Soil Coordinator shall assess soil conditions for contaminants in designated excavation area/segment. The completed Soil Determination Checklist, GRC133, shall be attached to the GRC 927.

GRC Soil Coordinator: \_\_\_\_\_ Date: \_\_\_\_\_

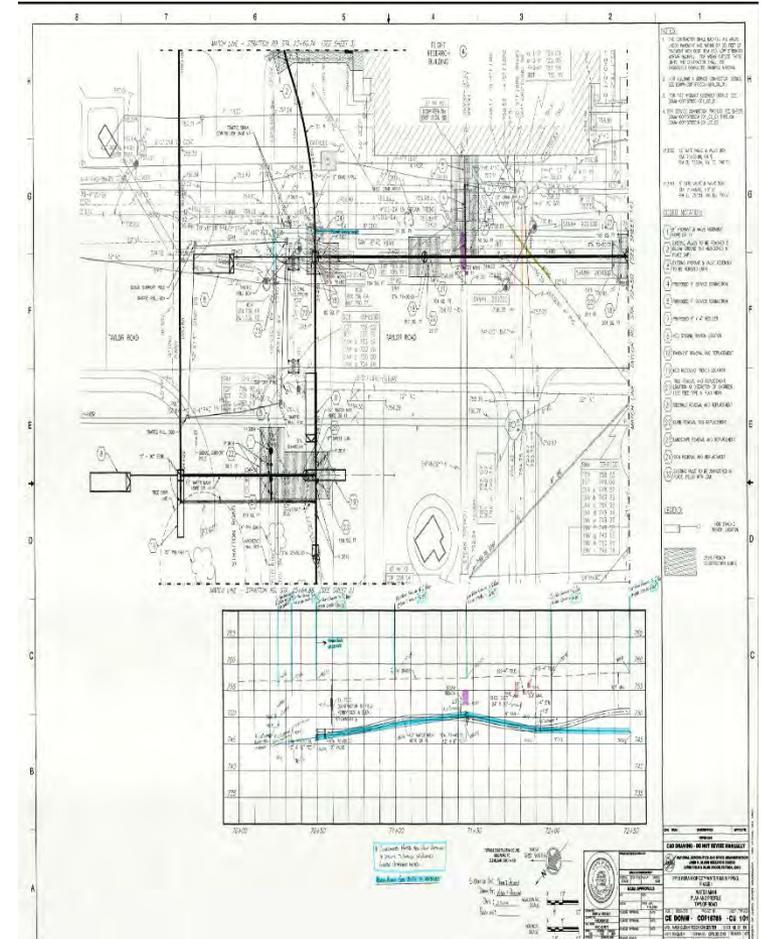
<b>PART A.</b>		
<b>Step 1. NASA/SSC Initiator (NOTE: Provide 48 hours advance notice to surveyors prior to marking.)</b>		
NASA/SSC Initiator John Q. Initiator, NASA or SSC	Telephone number 216-555-5555 ext. 5	Date 04/13/2021
Contract number/Project title FY21 Construct SMC Building, Taylor Road		
Prime Contractor ABC Prime Contracting Co, Inc.	Telephone number 216-555-5555 ext. 1	
Excavation Contractor I Have A Backhoe Excavation Contracting Co, llc	Telephone number 440-555-5555 ext. 9	
Contractor Excavation competent person Homer P. Vitruvian	Telephone number 440-781-6666	

# EXCAVATION 101

- GRC EXCAVATION PERMIT

- PERMIT PART A

- Step 1 - NASA/SSC Initiator
- EXCAVATION PERMIT WORK AREA
- The contractor will attach a (pdf) construction drawing to each PART A permit with the **WORK AREA** defined by dimensions.
- A description of work activities shall be included.
- **THE PERMIT SHALL ONLY BE APPLICABLE TO THE APPROVED DEFINED AREA.**



# EXCAVATION 101

- GRC EXCAVATION PERMIT

- PERMIT PART A

- Step 1 - NASA/SSC Initiator
- 48 Hours advance notice to Surveyors

National Aeronautics and Space Administration		Excavation Permit	Civil Systems Use Only Permit Expiration Date
<b>PART A.</b>			
<b>Step 1. NASA/SSC Initiator</b>		<i>(NOTE: Provide 48 hours advance notice to surveyors prior to marking.)</i>	
NASA/SSC Initiator	Telephone number	Date	
Contract number/Project title			
Prime Contractor		Telephone number	
Excavation Contractor		Telephone number	
Contractor Excavation contact person		Telephone number	
Project scope and limits			
Work area defined: (Work area limited approximately 400 linear feet or 400' x 110' area)			
LF	Area	Depth	
NOTE: The contractor must mark the center line of new utility installed with appropriate stakes and color in area project segment and excavation limits with white paint. Contractor to also submit marked up drawing.			
Excavation dates: Projected start =		Finish =	NOTE: Permit valid 3 months after final signature.
Click on the button to electronically submit the permit.			<b>SUBMIT</b>
<b>Step 2. GRC Soil Coordinator</b>			
GRC Soil Coordinator shall assess soil conditions for contaminants in designated excavation area/segment. The completed Soil Determination Checklist, GRC133, shall be attached to the GRC 927.			
Notes:			
GRC Soil Coordinator:		Date:	
<b>Step 3. Safety and Health Division (SH&amp;D)</b>			
SH&D Evaluation:			
SH&D shall perform a preliminary confined space determination and verify excavation process being adhered to.			
Notes:			
The NASA Surveyor shall mark the location of any existing utility line that may be encountered during excavation. The NASA contact shall coordinate all interfaces between the contractor and the NASA Surveyor.			
Notes:			
The contractor must contact OUPS at 1-800-362-2764 or 811: <input type="checkbox"/> Yes <input type="checkbox"/> Not applicable			
Surveyor:		Date:	
<b>Step 5. Excavation and Infrastructure Approval</b>			
The NASA/SSC initiator must acquire an area clearance. <input type="checkbox"/> Yes <input type="checkbox"/> Not applicable			
Comments:			
System Manager (For the utility being installed):		Telephone number:	Date:
Civil System Manager:		Telephone number:	Date:
Permit is valid for 3 months after step 5 is complete or until work is complete, whatever is more stringent. Proceed to use Part B. (Non-maintenance projects.)			
GRC 927 06/14 (1.0)		PREVIOUS EDITIONS ARE OBSOLETE	
		Page 1 of 4	

***(NOTE: Provide 48 hours advance notice to surveyors prior to marking.)***

# EXCAVATION 101

- GRC EXCAVATION PERMIT

- PERMIT PART A

- Step 1 - NASA/SSC Initiator
- EXCAVATION PERMIT WORK AREA

- Limited to 400 linear foot section or approximately 1 Acre.
- Divided/organized by street, parking lot, building location.
- Contractor shall submit desired area for consideration.
- Civil Systems Manager approves excavation limits

**NASA** National Aeronautics and Space Administration  
**Excavation Permit** Civil Systems Use Only  
Permit Expiration Date

**PART A**  
**Step 1. NASA/SSC Initiator** (NOTE: Provide 48 hours advance notice to surveyors prior to marking.)

NASA/SSC Initiator \_\_\_\_\_ Telephone number \_\_\_\_\_ Date \_\_\_\_\_

Contract number/Project title \_\_\_\_\_

Prime Contractor \_\_\_\_\_ Telephone number \_\_\_\_\_

Excavation Contractor \_\_\_\_\_ Telephone number \_\_\_\_\_

Contractor Excavation competent person \_\_\_\_\_ Telephone number \_\_\_\_\_

Project scope and limits \_\_\_\_\_

Work area defined: (Work area limited approximately 400 linear feet or 400' x 110' area)  
LF \_\_\_\_\_ Area \_\_\_\_\_ Depth \_\_\_\_\_

NOTE: The contractor must mark the center line of new utility installed with appropriate stakes and color in area project segment and excavation limits with white paint. Contractor to also submit marked up drawing.  
Excavation dates: Projected start = \_\_\_\_\_ Finish = \_\_\_\_\_ NOTE: Permit valid 3 months after final signature.

Step 2. GRC Soil Coordinator  
GRC Soil Coordinator shall assess soil conditions for contaminants in designated excavation area/segment. The completed Soil Determination Checklist, GRC133, shall be attached to the GRC 927.  
Notes: \_\_\_\_\_

GRC Soil Coordinator: \_\_\_\_\_ Date: \_\_\_\_\_

Step 3. Safety and Health Division (SH&D)  
SH&D Evaluation:  
SH&D shall perform a preliminary confined space determination and verify excavation process being adhered to.  
Notes: \_\_\_\_\_

GRC 199, Confined Space Entry permit is required.

SH&D Determination: \_\_\_\_\_ Date: \_\_\_\_\_

Step 4. NASA Surveyor  
Excavation Identification/Marking: \_\_\_\_\_

Click on the button to electronically submit the permit. **SUBMIT**

**Project scope and limits**

Install new utilities for construction of SMC Bldg, Domestic Water Supply on Taylor Road Segment 1 by open cut

**Work area defined:** (Work area limited approximately 400 linear feet or 400' x 110' area)

LF 250' Area 2500sf (0.06ac) Depth 8'

**NOTE:** The contractor must mark the center line of new utility installed with appropriate stakes and color in area project segment and excavation limits with white paint. Contractor to also submit marked up drawing.

Excavation dates: Projected start = 04/28/2021 Finish = 05/31/2021 **NOTE:** Permit valid 3 months after final signature.

Click on the button to electronically submit the permit. **SUBMIT**

# EXCAVATION 101

- GRC EXCAVATION PERMIT

- PERMIT PART A

- Step 1 - NASA/SSC Initiator
- EXCAVATION PERMIT WORK AREA
- Permit will be CLOSED after 3 months or when activities in the permitted WORK AREA are complete
- Multiple crews operating simultaneously must have individual permits for each crew
- Contractor shall request renewal of permit every two weeks or when re-entering an area for refreshing the markings

National Aeronautics and Space Administration		Excavation Permit	Civil Systems Use Only Permit Expiration Date
<b>PART A.</b>			
<b>Step 1. NASA/SSC Initiator (NOTE: Provide 48 hours advance notice to surveyors prior to marking.)</b>			
NASA/SSC Initiator	Telephone number	Date	
Contract number/Project title			
Prime Contractor	Telephone number:		
Excavation Contractor	Telephone number:		
Contractor Excavation competent person	Telephone number		
Project scope and limits			
Work area defined: (Work area limited approximately 400 linear feet or 400' x 110' area)			
LF	Area	Depth	
NOTE: The contractor must mark the center line of new utility installed with appropriate stakes and color in area project recovered and excavation limits with white paint. Contractor to also submit marked up drawing.			
Excavation dates: Projected start =	Finish =	NOTE: Permit valid 3 months after final signature.	
Click on the button below to return to the previous page.			
<b>Step 2. GRC Soil Coordinator</b>			
GRC Soil Coordinator shall assess soil conditions for contaminants in designated excavation area/segment. The completed Soil Determination Checklist, GRC133, shall be attached to the GRC 927.			
Notes:			
GRC Soil Coordinator:			Date:
<b>Step 3. Safety and Health Division (SH&amp;D)</b>			
<b>SH&amp;D Evaluation:</b>			
SH&D shall perform a preliminary confined space determination and verify excavation process being adhered to.			
Notes:			
<input type="checkbox"/> GRC 199, Confined Space Entry Permit is required.			
SH&D Determination:			Date:
<b>Step 4. NASA Surveyor</b>			
<b>Excavation Identification/Marking:</b>			
The NASA Surveyor shall mark the location of any existing utility line that may be encountered during excavation. The NASA contact shall coordinate all activities between the contractor and the NASA Surveyor.			
Notes:			
The contractor must contact OUPS at 1-800-362-2764 or 811: <input type="checkbox"/> Yes <input type="checkbox"/> Not applicable			
Surveyor:			Date:
<b>Step 5. Permitting and Infrastructure Approval</b>			
Date:			
Civil System Manager:	Telephone number:	Date:	
Permit is valid for 3 months after step 5 is complete or until work is complete, whatever is more stringent. Proceed to use Part B. (Non-maintenance projects.)			
GRC 927 06/14 (1.0) PREVIOUS EDITIONS ARE OBSOLETE Page 1 of 4			

**NOTE: Permit valid 3 months after final signature.**

# EXCAVATION 101

- GRC EXCAVATION PERMIT

- PERMIT PART A

- Step 1 - NASA/SSC Initiator

- Fillable .pdf Form – all required initiator fields filled out digitally
- Attachments scanned or electronically produced are attached in .pdf format
- Form is submitted digitally by clicking on the "SUBMIT" button to e-mail to the appropriate location

**NASA** National Aeronautics and Space Administration

**Excavation Permit**

Civil Systems Use Only  
Permit Expiration Date

**PART A**

**Step 1. NASA/SSC Initiator** (NOTE: Provide 48 hours advance notice to surveyors prior to marking.)

NASA/SSC Initiator Telephone number Date

Contract number/Project title

Prime Contractor Telephone number

Excavation Contractor Telephone number

Contractor Excavation competent person Telephone number

Project scope and limits

Work area defined: (Work area limited approximately 400' linear feet or 400' x 110' area)  
LF Area Depth

NOTE: The contractor must mark the center line of new utility installed with appropriate stakes and color in area project segment and excavation limits with white paint. Contractor to also submit marked up drawing.

Excavation dates: Projected start = Finish = NOTE: Permit valid 3 months after final signature.

Click on the button to electronically submit the permit. **SUBMIT**

**Step 2. GRC Soil Coordinator**

GRC Soil Coordinator shall assess soil conditions for contaminants in designated excavation area/segment. The completed Soil Determination Checklist, GRC133, shall be attached to the GRC 927.

Notes:

GRC Soil Coordinator: Date:

**Step 3. Safety and Health Division (SH&D)**

**SH&D Evaluation:**

SH&D shall perform a preliminary confined space determination and verify excavation process being adhered to.

Notes:

GRC 199, Confined Space Entry Permit is required.

SH&D Determination: Date:

**Step 4. NASA Surveyor**

**Excavation Identification/Marking:**

The NASA Surveyor shall mark the location of any existing utility line that may be encountered during excavation. The NASA contact shall coordinate all interfaces between the contractor and the NASA Surveyor.

Notes:

System Manager (For the utility being installed) Telephone number: Date:

Civil System Manager Telephone number: Date:

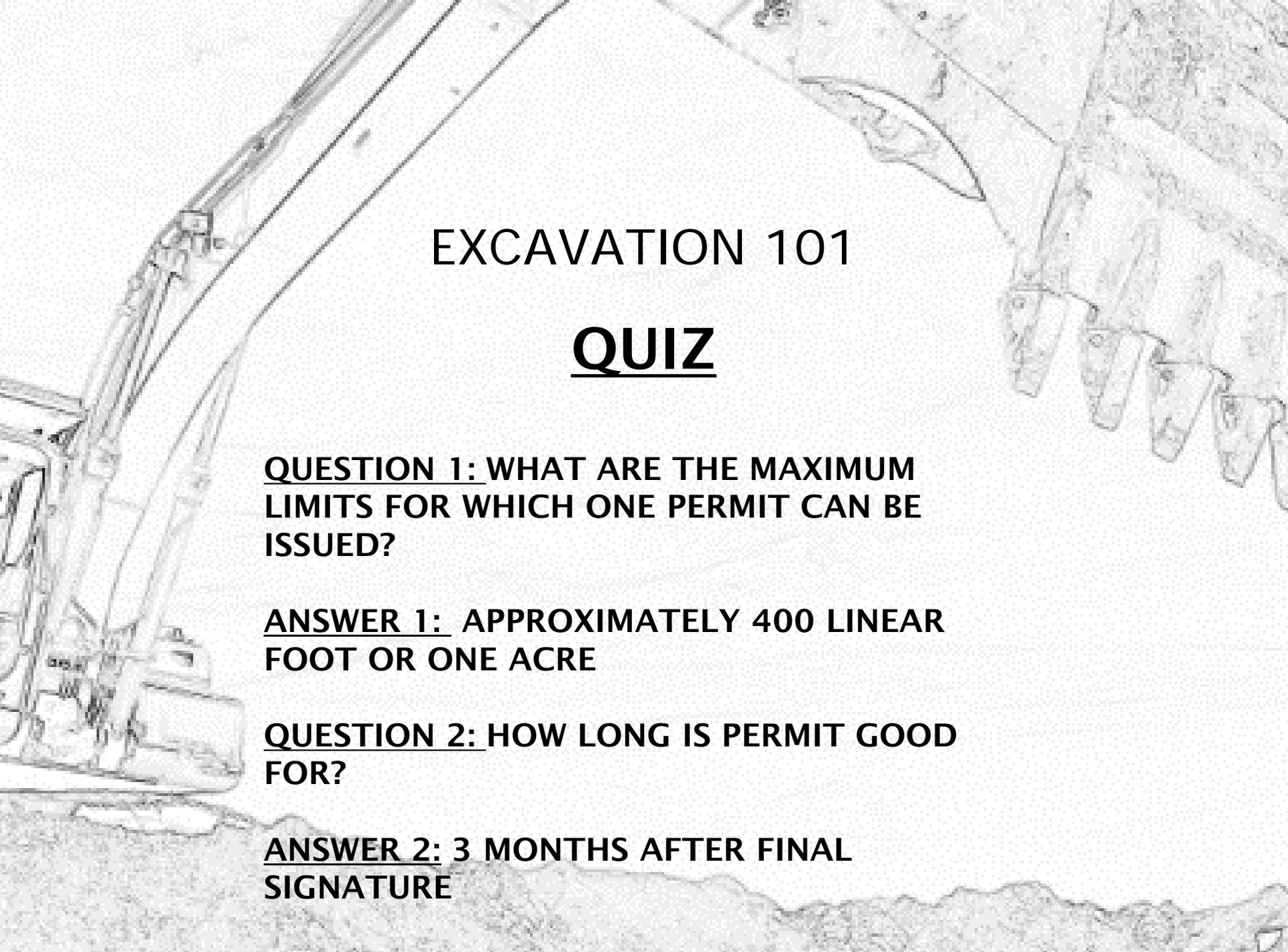
Permit is valid for 3 months after step 5 is complete or until work is complete, whatever is more stringent. Proceed to use Part B. (Non-maintenance projects.)

GRC 927 06/14 (1.0) PREVIOUS EDITIONS ARE OBSOLETE Page 1 of 4

Click on the button to electronically submit the permit.

**SUBMIT**

ONCE **STEP 1** IS COMPLETE JUST CLICK **SUBMIT!** THE PERMIT WILL BE ROUTED VIA CONSTRUCTION EROOM.

The background of the slide is a grayscale, high-contrast image of an excavator bucket. The bucket is shown from a top-down perspective, with its teeth pointing downwards. The image is slightly faded and serves as a backdrop for the text.

# EXCAVATION 101

## QUIZ

**QUESTION 1: WHAT ARE THE MAXIMUM LIMITS FOR WHICH ONE PERMIT CAN BE ISSUED?**

**ANSWER 1: APPROXIMATELY 400 LINEAR FOOT OR ONE ACRE**

**QUESTION 2: HOW LONG IS PERMIT GOOD FOR?**

**ANSWER 2: 3 MONTHS AFTER FINAL SIGNATURE**



# EXCAVATION 101

- GRC EXCAVATION PERMIT
  - PERMIT PART B1

**Excavation Permit**

**PART B1: Utility Verification and Marking Log**

Civil systems require use of log?  Yes  No Civil Systems Signature: \_\_\_\_\_

**NOTE:** All surveying, soil determination, and confined space entry activities shall be coordinated through the appropriate NASA CM NASA/SSC Initiator. Excavation Contractor is responsible to maintain B1 Utility Verification and Marking Log. Contractor required to formally submit permit after permit is complete with as built.

**EXCAVATION COMPLETION:** The NASA Surveyor must locate the new utility and confirm the location and/or changes to existing utilities prior to "backfilling." The contractor shall provide "red-line" as-built information to NASA regarding the excavation (exact location, depth, variations from existing drawings, etc.) 8 business hours (minimum) notification shall be given to allow for verification of the underground utility location before back-fill activities commence.


**NOTE:** All surveying, soil determination, and confined space entry activities shall be coordinated through the appropriate NASA CM NASA/SSC Initiator. Excavation Contractor is responsible to maintain B1 Utility Verification and Marking Log. Contractor required to formally submit permit after permit is complete with as built.

**EXCAVATION COMPLETION:** The NASA Surveyor must locate the new utility and confirm the location and/or changes to existing utilities prior to "backfilling." The contractor shall provide "red-line" as-built information to NASA regarding the excavation (exact location, depth, variations from existing drawings, etc.) 8 business hours (minimum) notification shall be given to allow for verification of the underground utility location before back-fill activities commence.

GRC 927 09/14 (1.0) PREVIOUS EDITIONS ARE OBSOLETE. Page 2 of 4

- Part B1 is maintained by the Contractor
- Contractor required to formally submit permit after permitted work is complete with as- built drawings.
- 8 business hour notice to Surveyor to allow verification of underground utility locations prior to backfilling

# EXCAVATION 101

- GRC EXCAVATION PERMIT

- PERMIT PART B2

- Contractor required to pothole all utilities prior to excavation
- Waivers can be granted by the Civil Systems Manager.
- Contractor to contact CM/Inspector to initiate utility verification
- Surveyor will verify the exposed utilities match the URDs, and per spec.
- Questions to be resolved by NASA Engineer

The image shows a thumbnail of the 'Excavation Permit' form. At the top left is the NASA logo and the text 'National Aeronautics and Space Administration'. The title 'Excavation Permit' is centered at the top. Below the title is 'PART B2. Potholing Log'. A section asks 'Civil systems require use of log?' with 'Yes' and 'No' checkboxes and a 'Civil Systems' dropdown menu. Below this is a table with 11 columns: 'ID Tag No.', 'Utility ID or Drawing Reference ID', 'Location/ Station', 'Marked by NASA Surveyor', 'Accepted by Contractor Competent Person (Date)', 'Contractor Competent Person (Initials)', 'Pothole/ Exposed (Date)', 'Verified by NASA (Date)', 'Utility Verified by NASA Surveyor or Civil Engineer (Initials)', 'NASA Construction Manager/ Inspector', and 'Notes'. At the bottom, there are two footnotes: 'Excavation Contractor is responsible to maintain B2 Potholing Log' and 'Contractor required to formally request permit after permit is complete with as built'. The footer includes 'GRC 927 0814 (1.0)' and 'PREVIOUS EDITIONS ARE OBSOLETE'.

This image provides a detailed view of the 'Excavation Permit' form. The header includes the NASA logo and 'National Aeronautics and Space Administration'. The title 'Excavation Permit' is prominently displayed. Below the title is 'PART B2. Potholing Log'. A red box highlights the section 'Civil systems require use of log?' which contains 'Yes' and 'No' checkboxes and a 'Civil Systems' dropdown menu. Below this is a table with 11 columns: 'ID Tag No.', 'Utility ID or Drawing Reference ID', 'Location/ Station', 'Marked by NASA Surveyor', 'Accepted by Contractor Competent Person (Date)', 'Contractor Competent Person (Initials)', 'Pothole/ Exposed (Date)', 'Verified by NASA (Date)', 'Utility Verified by NASA Surveyor or Civil Engineer (Initials)', 'NASA Construction Manager/ Inspector', and 'Notes'. At the bottom, there are two footnotes: 'Excavation Contractor is responsible to maintain B2 Potholing Log' and 'Contractor required to formally request permit after permit is complete with as built'. The footer includes 'GRC 927 0814 (1.0)' and 'PREVIOUS EDITIONS ARE OBSOLETE'.

# EXCAVATION 101

- GRC EXCAVATION PERMIT

- PERMIT PART B2

- Part B2 is maintained by the Contractor
    - Contractor required to formally submit permit after permitted work is complete with as- built drawings attached

NASA National Aeronautics and Space Administration

## Excavation Permit

**PART B2 Potholing Log**

Civil systems require use of log?  Yes  No Call Systems: \_\_\_\_\_

ID Tag No.	Utility ID or Drawing Reference ID	Location/Station	Marked by NASA Surveyor	Accepted by Contractor Competent Person (Date)	Contractor Competent Person (Initials)	Pothole Exposed (Date)	Verified by NASA Surveyor or Civil Engineer (Initials)	Utility Verified by NASA Construction Manager/Inspector	Notes

• Excavation Contractor is responsible to maintain B2 Potholing Log.  
• Contractor required to formally submit permit after permit is complete with as built.

GRC 927 08/14 (1.0) PREVIOUS EDITIONS ARE OBSOLETE Page 3 of 4

• Excavation Contractor is responsible to maintain B2 Potholing Log.  
• Contractor required to formally submit permit after permit is complete with as built.

GRC 927 08/14 (1.0) PREVIOUS EDITIONS ARE OBSOLETE Page 3 of 4

# EXCAVATION 101

- GRC EXCAVATION PERMIT

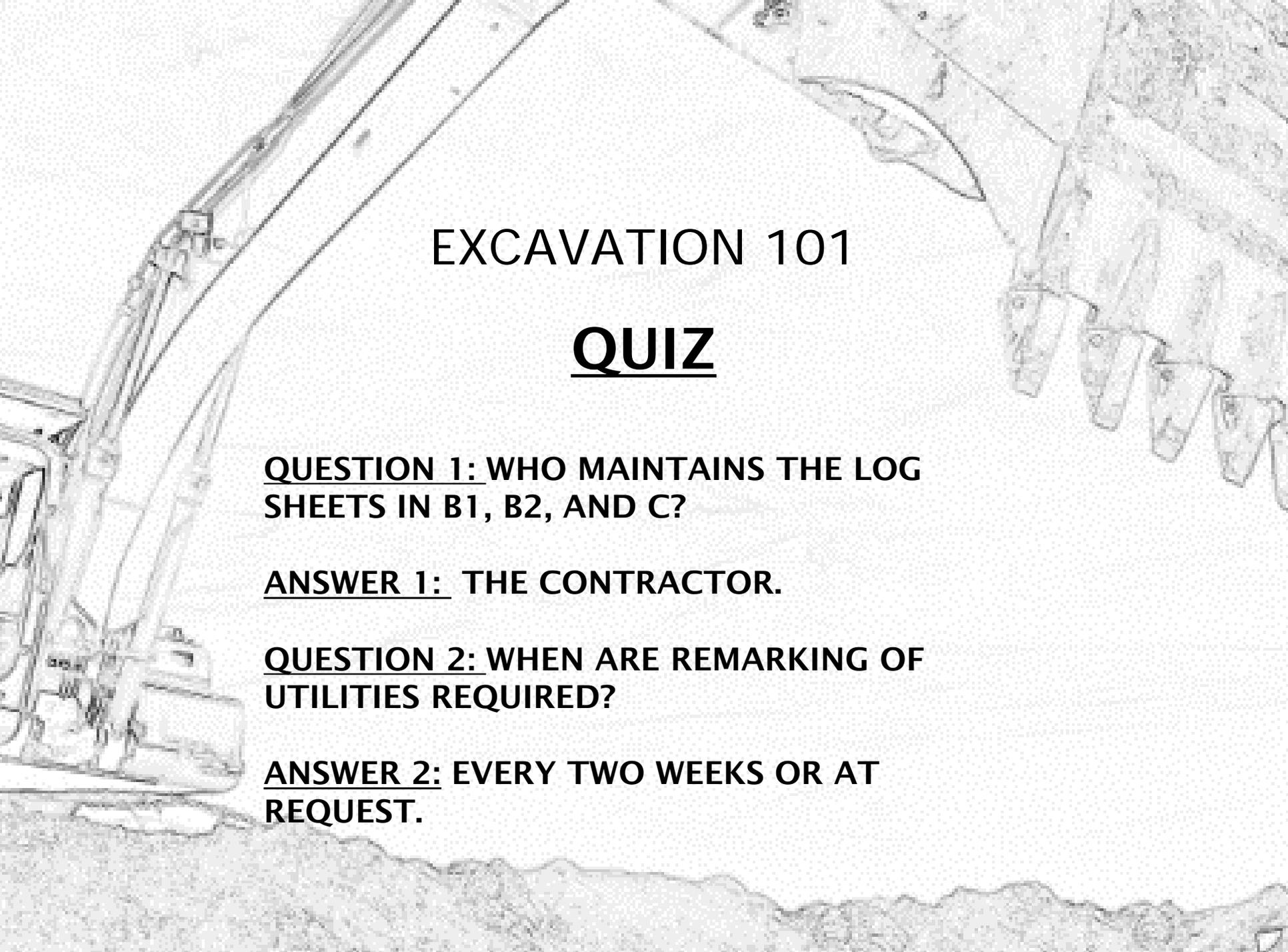
- PERMIT PART C

- Daily field tag up meetings will be held between CM/Inspector and Contractor
- The CM/Inspector shall not sign off on any daily permit without design drawings, underground record drawing, and field survey markings on-site and complete
- The contractor may only proceed with the work scope discussed for that specific day.

The image shows a thumbnail of the 'Excavation Permit' form. The header includes the NASA logo and the text 'National Aeronautics and Space Administration'. Below the header is the title 'Excavation Permit' and a sub-section 'PART C. Daily Meeting Log'. There are checkboxes for 'Civil systems require use of log?' with options 'Yes', 'No', and 'Civil Systems'. A table with 7 columns is visible: 'Date', 'NASA Construction Manger/Inspector', 'Prime Contractor', 'Contractor Excavation Competent Person', 'Machine Operator', 'URD and Excavation Manual Present', and 'Utilities cleared?'. The last column is labeled 'Work Activity Location and Brief Scope'. Below the table are numbered instructions 1 through 6.

This is a full view of the 'Excavation Permit' form, enclosed in a red border. It features the NASA logo and the text 'National Aeronautics and Space Administration' in the top left. The title 'Excavation Permit' is centered at the top. Below the title is the section 'PART C. Daily Meeting Log'. There are checkboxes for 'Civil systems require use of log?' with options 'Yes', 'No', and 'Civil Systems'. A table with 7 columns is visible: 'Date', 'NASA Construction Manger/Inspector', 'Prime Contractor', 'Contractor Excavation Competent Person', 'Machine Operator', 'URD and Excavation Manual Present', and 'Utilities cleared?'. The last column is labeled 'Work Activity Location and Brief Scope'. Below the table are numbered instructions 1 through 6.



The background of the slide is a grayscale, halftone-style image of an excavator bucket. The bucket is shown from a high angle, with its teeth pointing downwards. The image is slightly faded and serves as a backdrop for the text.

# EXCAVATION 101

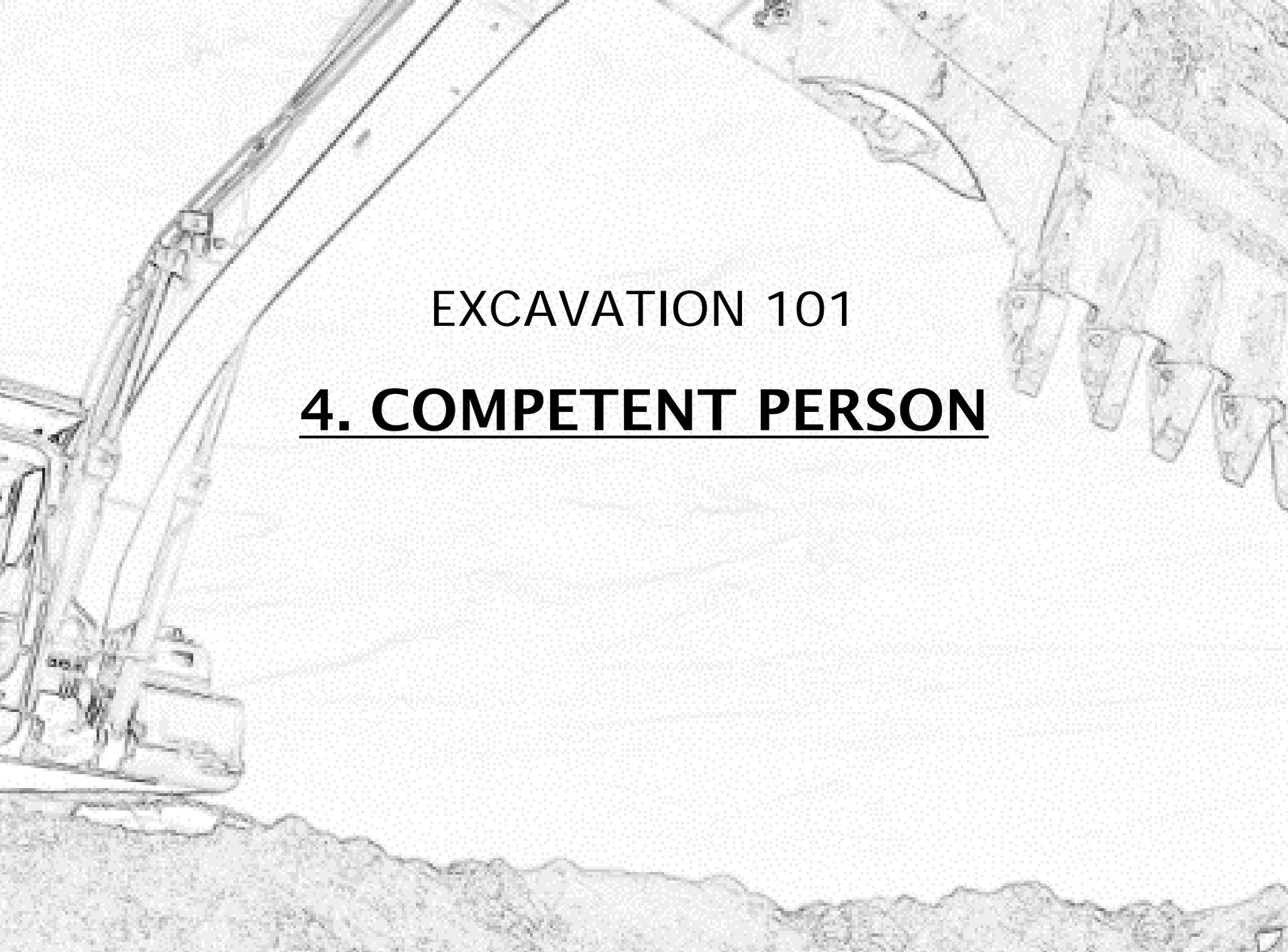
## QUIZ

**QUESTION 1: WHO MAINTAINS THE LOG SHEETS IN B1, B2, AND C?**

**ANSWER 1: THE CONTRACTOR.**

**QUESTION 2: WHEN ARE REMARKING OF UTILITIES REQUIRED?**

**ANSWER 2: EVERY TWO WEEKS OR AT REQUEST.**

The background of the slide is a grayscale, halftone-style image. On the left side, the arm and bucket of an excavator are visible, positioned as if about to dig into a trench. On the right side, the vertical wall of a trench is shown, with several vertical shoring or lagging beams supporting it. The overall scene is a technical or safety-related illustration of excavation work.

## EXCAVATION 101

# 4. COMPETENT PERSON

# EXCAVATION 101

- **COMPETENT PERSON**

## EXCAVATOR SUPERVISION REQUIREMENTS

Contractor will provide formal submittal to Project Manager.

Contractor must provide the following:

- **EXCAVATION COMPETENT PERSON** (Permit Part A),

*or*

- **EXCAVATION & UTILITY COMPETENT PERSON** (Permit Part B)

to oversee each permitted excavation. This person shall be at the physical excavation site 100% of the time comparing construction documents to the URDs, auditing the excavation process, evaluating utility markings, evaluating typical symbols vs. details and to ensure the permit process is followed.

# EXCAVATION 101

## • COMPETENT PERSON

The EXCAVATION COMPETENT PERSON assigned to supervise PERMIT PART A activities shall:

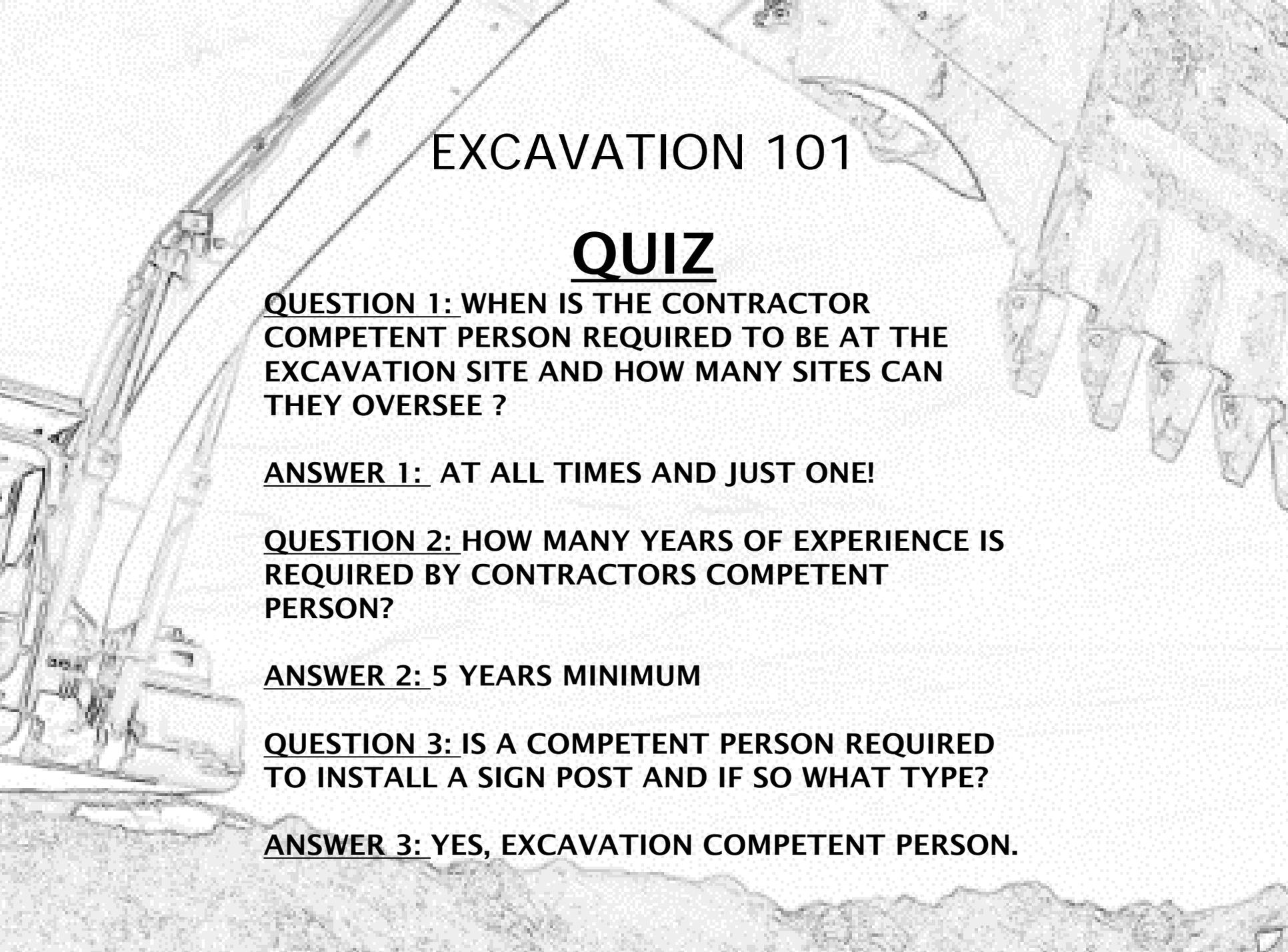
1. Have a working knowledge of trenching, excavation, horizontal directional drilling, underground construction, shoring, and soil types.
2. Have the ability to assure that all underground utilities are located, field verified, and clearly marked prior to excavation.
3. Be knowledgeable in applicable excavation regulations to include OSHA 29CFR1926. Have knowledge of trench collapse prevention, ventilation and air monitoring requirements (where applicable), ground water control, personal protective equipment, and emergency procedures as they pertain to underground construction and utility work. A minimum 5 years excavating experience is required.
4. Have the ability to notify the prime contractor or government (as applicable) of any non-conformance issues and document them; and to provide any corrective actions to mitigate hazards or non-conformance issues.

# EXCAVATION 101

- **COMPETENT PERSON**

**In addition** to the requirements specified in the previous list, the **EXCAVATION & UTILITY COMPETENT PERSON** that is assigned to supervise **PERMIT PART B** activities shall:

5. Have the ability to review, understand, and interpret URDs, contract drawings and specifications.
6. Have the ability to oversee and witness underground construction and utility work to ensure that established processes are followed. A minimum of 5 years utility installation experience is required.
7. Be knowledgeable in applicable rules and regulations to include 29CFR1926 and installation of utilities such as domestic water ( IE fire hydrants, thrust blocks, testing, cleaning and chlorination), sewers, duct banks, natural gas, and other pressure pipes, as appropriate to the assigned task.
8. Be capable of identifying existing and predictable hazards in the surroundings of underground utility construction and understanding the corrective measures to eliminate them.

The background of the slide is a grayscale, high-contrast image of an excavator bucket. The bucket is positioned diagonally, with its tip pointing towards the bottom right corner. The image shows the mechanical details of the bucket, including the teeth and the hydraulic arm structure. The overall tone is technical and industrial.

# EXCAVATION 101

## QUIZ

**QUESTION 1: WHEN IS THE CONTRACTOR COMPETENT PERSON REQUIRED TO BE AT THE EXCAVATION SITE AND HOW MANY SITES CAN THEY OVERSEE ?**

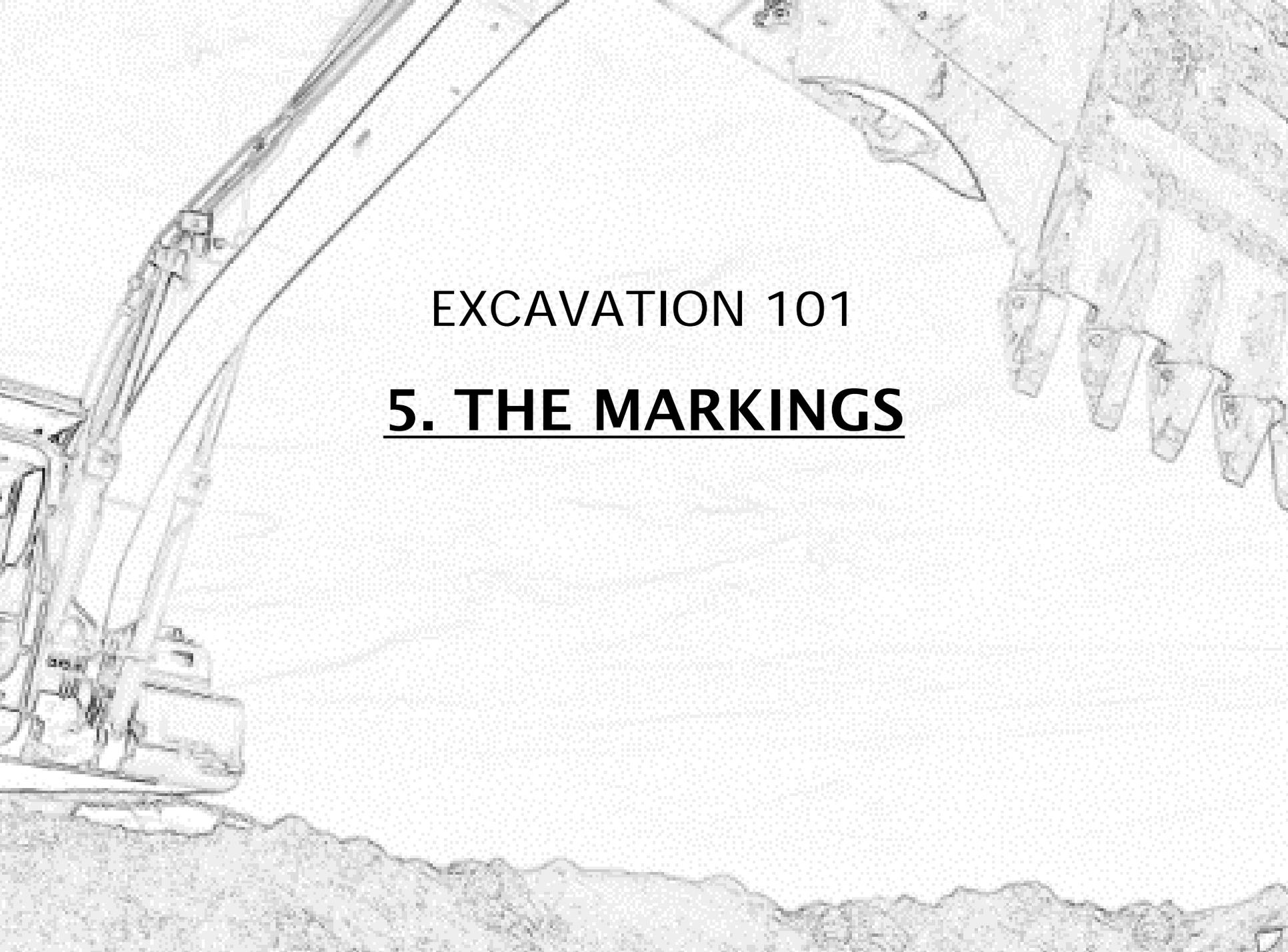
**ANSWER 1: AT ALL TIMES AND JUST ONE!**

**QUESTION 2: HOW MANY YEARS OF EXPERIENCE IS REQUIRED BY CONTRACTORS COMPETENT PERSON?**

**ANSWER 2: 5 YEARS MINIMUM**

**QUESTION 3: IS A COMPETENT PERSON REQUIRED TO INSTALL A SIGN POST AND IF SO WHAT TYPE?**

**ANSWER 3: YES, EXCAVATION COMPETENT PERSON.**



EXCAVATION 101

**5. THE MARKINGS**

# EXCAVATION 101

- THE MARKINGS

## NASA GRC MARKING STANDARDS

- The American Public Works Association (APWA) is the source for recommended color codes for utility marking at NASA GRC. Utilities are marked using colored flags and/or paint to identify the underground service.

WHITE - By Contractor – Planned Excavation		
PINK	Temporary Survey Markings Area of Concern	( ! C ! )
RED	Electric Power	( E )
YELLOW	Natural Gas	( NG )
	Service Air	( SA )
	Steam	( ST )
	Combustion Air	( CMBA )
	Fuel / Oil	( FO )
	Waste Gas	( WG )
	Carbon Dioxide	( Co2 )
ORANGE	Liquid Fuel	( LF )
	Hi Press. Nitrogen	( HPN2 )
	Communications	( TEL )
	Domestic Water	( DW )
	Cooling Tower Water	( CTW )
BLUE	Chilled Water	( CHW )
	Raw Water	( RW )
	Clarified Water	( CW )
	Hot Water	( HW )
	De-Ionized Water	( DIW )
GREEN	Fire Protection Water	( FPW )
	Storm Sewer	( S )
	Sanitary Sewer	( SAN )
	Indust . Waste Sewer	( IWS )

# EXCAVATION 101

- THE MARKINGS

## NASA GRC MARKING STANDARDS

- The Contractor shall stake the alignment of new infrastructure based upon the design drawing layout and prior to requesting utility markings. The contractor shall also delineate proposed excavation limits based upon the design requirements using white paint.

WHITE - By Contractor – Planned Excavation		
PINK	Temporary Survey Markings Area of Concern	( ! C ! )
RED	Electric Power	( E )
YELLOW	Natural Gas	( NG )
	Service Air	( SA )
	Steam	( ST )
	Combustion Air	( CMBA )
	Fuel / Oil	( FO )
	Waste Gas	( WG )
	Carbon Dioxide	( Co2 )
ORANGE	Liquid Fuel	( LF )
	Hi Press. Nitrogen	( HPN2 )
	Communications	( TEL )
	Domestic Water	( DW )
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BLUE	Raw Water	( RW )
	Clarified Water	( CW )
	Hot Water	( HW )
	De-Ionized Water	( DIW )
	Fire Protection Water	( FPW )
GREEN	Storm Sewer	( S )
	Sanitary Sewer	( SAN )
	Indust . Waste Sewer	( IWS )

# EXCAVATION 101

- THE MARKINGS

## NASA GRC MARKING STANDARDS

- The NASA Surveyor or Utility Locator will identify and mark the horizontal alignment of all known underground utilities crossing or within the proposed excavation limits using the colors and symbology shown on the following pages.
- Areas of Concern, where an actual utility location may not fall within the Tolerance Zone (described later), will also be identified for further exploration.

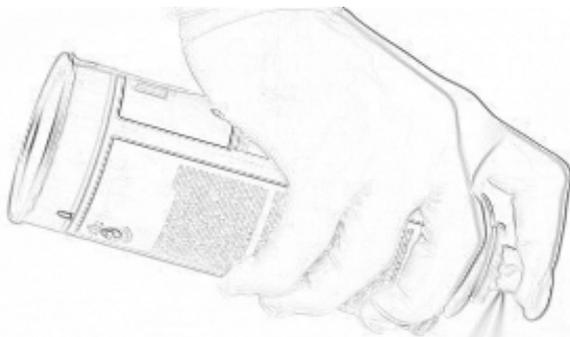
WHITE - By Contractor – Planned Excavation		
PINK	Temporary Survey Markings Area of Concern	( ! C ! )
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	Fire Protection Water	( FPW )
GREEN	Storm Sewer	( S )
	Sanitary Sewer	( SAN )
	Indust . Waste Sewer	( IWS )

# EXCAVATION 101

- THE MARKINGS

## NASA GRC MARKING STANDARDS

- Excavation by Hand Digging (Pot Holing), Vacuum Excavation, or Hydro Excavation, will be required at all utilities within the Tolerance Zone, including Areas of Concern.



### WHITE - By Contractor – Planned Excavation

**PINK** Temporary Survey Markings  
Area of Concern ( ! C ! )

**RED** Electric Power ( E )

Natural Gas ( NG )  
Service Air ( SA )  
Steam ( ST )  
Combustion Air ( CMBA )

**YELLOW** Fuel / Oil ( FO )  
Waste Gas ( WG )  
Carbon Dioxide ( Co2 )  
Liquid Fuel ( LF )  
Hi Press. Nitrogen ( HPN2 )

**ORANGE** Communications ( TEL )

Domestic Water ( DW )  
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Raw Water ( RW )  
Clarified Water ( CW )  
Hot Water ( HW )  
De-Ionized Water ( DIW )  
Fire Protection Water ( FPW )

**BLUE**

**GREEN** Storm Sewer ( S )  
Sanitary Sewer ( SAN )  
Indust . Waste Sewer ( IWS )

# EXCAVATION 101

## • THE MARKINGS

### CONTRACTOR MARKINGS

Excavators at NASA GRC are **REQUIRED** to pre-mark with white paint the limits of the intended excavation to clearly indicate for the Utility Locator and CM/Inspectors.



For single point excavation such as borings for soil samples, for installing sign posts or fence posts, or planting a tree, mark the location with white paint using dashes.

For continuous excavation, such as trenching, boring and trenchless excavation, mark the center line of excavation with dashes in white paint. Excavation width (in feet) shall be indicated on either side of the center line in legible numbers.

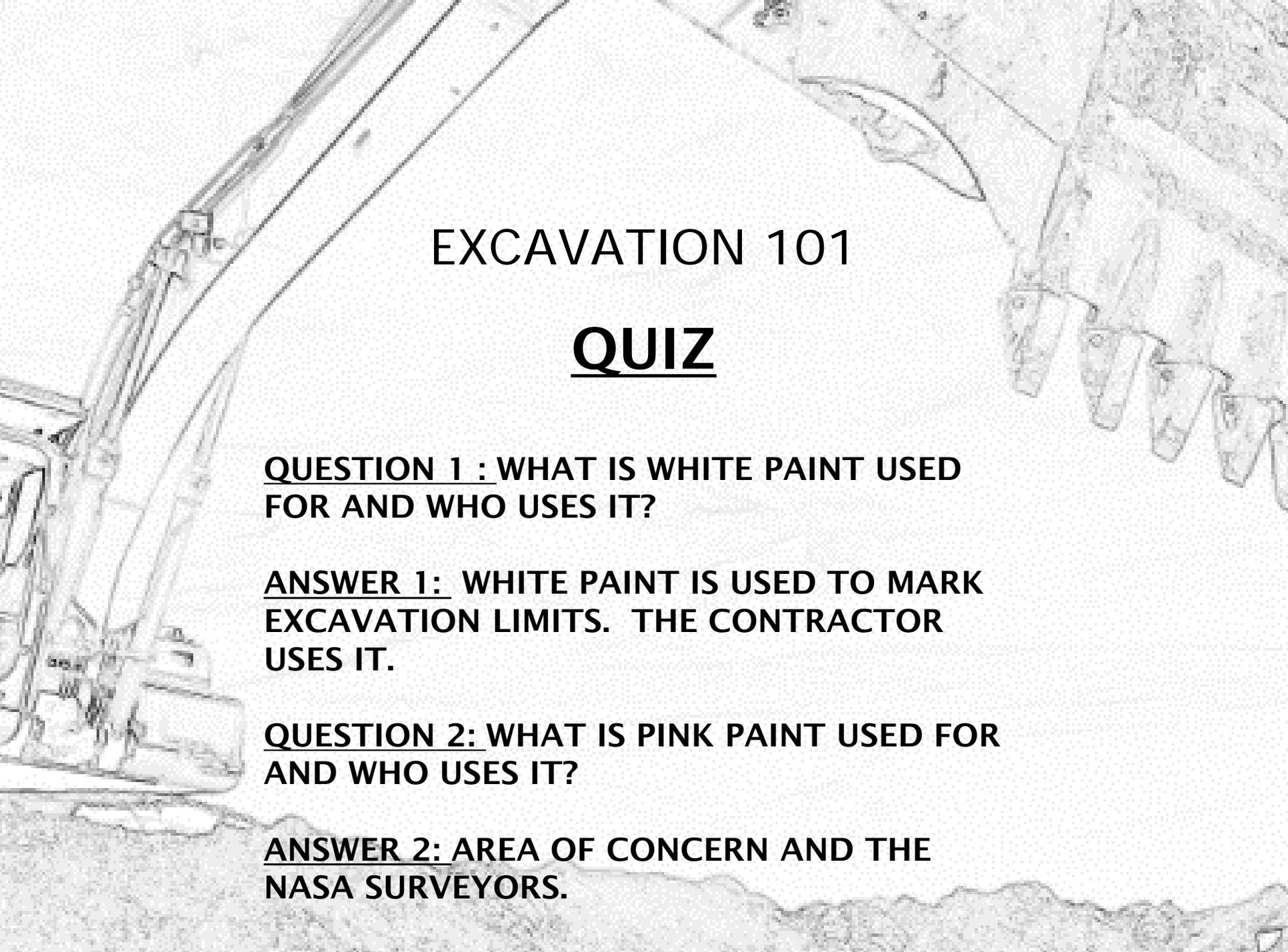


For area excavations such as grading or scraping mark the perimeter with dashes in white paint at intervals close enough to clearly establish the maximum limit of the disturbance.

White flags or stakes may be used in place of white paint. Markers used to identify the excavation area shall not be excessive or oversized.

# THE FIELD MARKINGS



The background of the slide is a grayscale, high-contrast image of an excavator bucket. The bucket is shown from a top-down perspective, with its teeth pointing downwards. The image is slightly faded and serves as a backdrop for the text.

# EXCAVATION 101

## QUIZ

**QUESTION 1 : WHAT IS WHITE PAINT USED FOR AND WHO USES IT?**

**ANSWER 1: WHITE PAINT IS USED TO MARK EXCAVATION LIMITS. THE CONTRACTOR USES IT.**

**QUESTION 2: WHAT IS PINK PAINT USED FOR AND WHO USES IT?**

**ANSWER 2: AREA OF CONCERN AND THE SURVEYORS.**

# EXCAVATION 101

## • THE MARKINGS

### LOCATOR MARKINGS

**Markers Appropriate for the Area:** Underground facilities and utilities will be marked using paint or flags in a combination appropriate for the area of proposed excavation. Marks will be placed at the beginning and end of the location area as needed to clearly identify the route of the underground utility.

**All markings** will be placed at the beginning and end of the Location Area and at a minimum interval of two feet but not more than fifty throughout the Location Area as needed to clearly identify the route of the underground utility.

**When flags are used** the identification abbreviation of the utility will be written on the flag using an indelible broad tip marking pen.

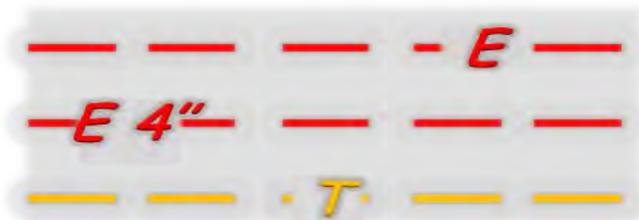
**Abandoned utilities** remain in place at many locations within the GRC facilities. Any abandoned utilities within the location area will be marked similar to an active utility with the addition of letters "**ABAN**".

# EXCAVATION 101

## • THE MARKINGS

### Marking Buried Cables:

- A. Where a single cable or un-encased conduit is present the location will be marked by placement of a mark a minimum of 1" wide and 12" long spaced at intervals over the approximate center of the utility



- B. If multiple cables or un-encased conduit are present they will be marked by placing a single mark over the approximate center of each line. If an individual un-encased conduit has a diameter greater than 2 inches the nominal size will be noted on the line:

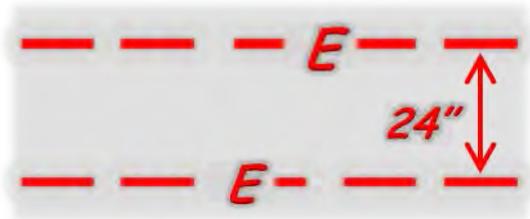
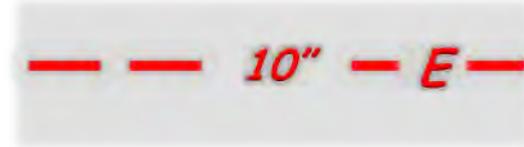
# EXCAVATION 101

## • THE MARKINGS

### Marking Conduit/Duct Bank:

The term "*Duct Bank*" is used for a structure containing one or more conduits and encased in concrete. Multiple runs of un-encased conduit will be identified as previously described in Marking Buried Cables (above).

- A. All concrete encased Duct Banks less than 12" wide are identified by a single mark or line with the utility type and estimated total width of the duct bank in inches:



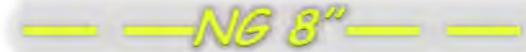
- B. For all concrete encased Duct Banks greater than 12" wide the boundary (width) is identified by parallel marks. A diamond is placed between the marks; and the no. of ducts horizontal (H) x the no. of ducts vertical (V) is indicated within the diamond symbol:

# EXCAVATION 101

## • THE MARKINGS

### Marking Pipe Lines:

Pipelines larger than 2 inches (nominal size): The physical location of a pipeline shall be represented by a single mark. The nominal size shall be noted:



### For All Pipelines:

- A. Pipelines that are inserted into casings will be marked to so indicate:
- B. Marks shall be placed at the beginning and the end of the location area and at intervals throughout as needed to clearly identify the pipeline location and width (diameter).
- C. All numbers identifying width shall be in inches



### Marking Termination Points:

Termination points, stub outs and dead ends will be marked as shown:



# EXCAVATION 101

## • THE MARKINGS

### Offset Marks:

Where marks may be subject to frequent destruction, offset marks can be used to supplement the primary marks:



At a clear distance a line parallel to the utility is marked, including a perpendicular arrow and a distance in feet to the actual location of the utility. The arrow indicates direction to the utility. The utility abbreviation and size are shown on the other side of the arrow.

### Marking Changes in Direction:

Changes in direction of an underground utility will be marked so as to clearly define the route:

### Valve Pits / Manholes / Vaults and Structures:

The perimeter of valve boxes, manholes, vaults and other buried obstructions will be marked with the appropriate color, abbreviation and name or type. Natural gas blow off pits and dual purge valve pits will include the location of the connecting line if known, otherwise an Area of Concern will be established and marked:



# EXCAVATION 101

## • THE MARKINGS

### Areas of Concern

An "Area of Concern" exists when the location of a utility is not shown on record drawings but the utility is presumed to exist based upon other evidence. These situations include, but are not limited to:

- An otherwise unidentified valve box, hand-hole, manhole or other system appurtenance
- A natural gas blowoff or purge valve structure showing no connecting line on legacy record drawings
- A building foundation or pavement edge where an underdrain would normally be installed but is not shown (not normally delineated on legacy record drawings)
- Electrical ground grid at building footings (not normally delineated on legacy record drawings).  
Double parallel pavement underdrains each side of curb are common at Lewis Field
- Cathodic protection test box showing no connecting line on legacy record drawings

Contractor shall treat Areas of Concern as Tolerance Zones.

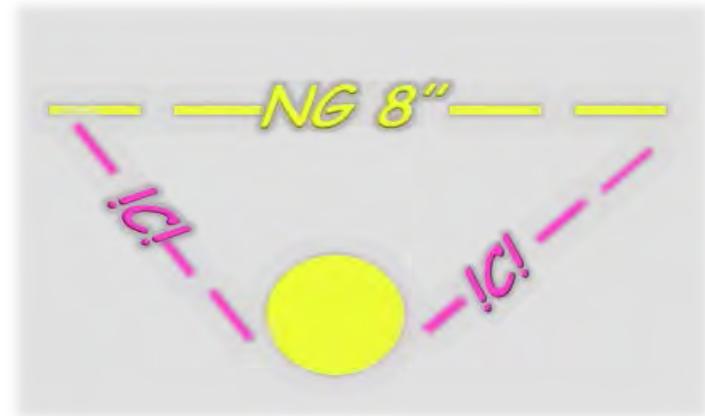
# EXCAVATION 101

## • THE MARKINGS

### Areas of Concern

An "Area of Concern" will be marked on the ground showing the estimated maximum limits of a potential encounter. Horizontal limits of such areas may be based upon a radius around a fixture; a bounding box between a fixture and a known line; or parallel lines based upon the estimated horizontal maximum potential variation in a single line.

This Example shows a natural gas line with an associated blowoff valve identified by its hand-hole lid (yellow circle). The location of the blowoff line is not shown on the record drawings. The Area of Concern for the blowoff line falls within the triangular area between the 8"NG line and the pit location indicated by the pink lines marked !C! The entire area will be hand excavated with caution until either the line is located or the tolerance zone limits are reached. Isolation valves for the 8"NG line should also be located and prepared for closure (keys in place) prior to potholing.



# EXCAVATION 101

## • THE MARKINGS

### ORC 3781.30 Duties of excavator:

When making excavations using traditional or trenchless technologies, the excavator shall do all of the following:

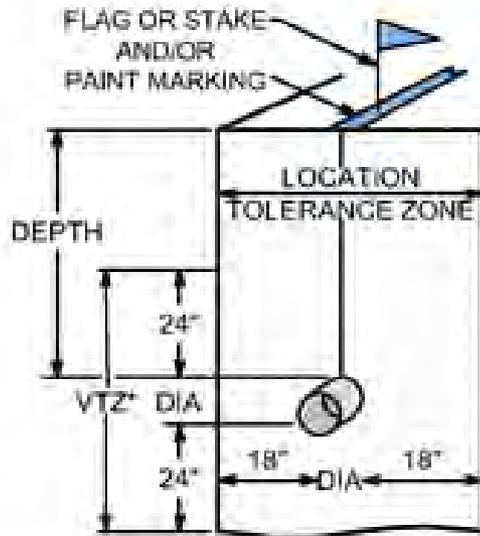
1. Maintain reasonable clearance between any underground facility and the cutting edge or point of powered equipment;
2. Protect and preserve the markings of tolerance zones of underground utility facilities until those markings are no longer required for proper and safe excavations;
3. When approaching and excavating within the tolerance zone of underground utility facilities with powered equipment, require an individual other than the equipment operator, to visually monitor the excavation activity for any indication of the underground utility facility;
4. Conduct the excavation within the tolerance zone of underground utility facilities in a careful , prudent, and nondestructive manner, when necessary, in order to prevent damage;
5. Excavate up to the total depth of the excavation to either determine the precise location of underground utility facilities or verify that the total depth of excavation is free of such facilities

# EXCAVATION 101

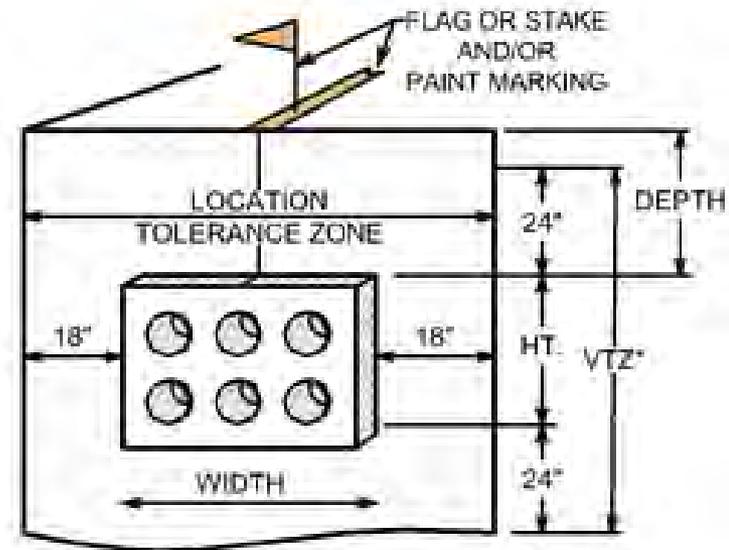
- THE MARKINGS

## EXCAVATION TOLERANCE ZONE - REMEMBER!

The "Tolerance Zone" is the total width of the underground utility plus 18 inches on each side. The Vertical Tolerance Zone (VTZ) extends from the elevation shown on the utility profile drawing 24 inches above the top edge and 24" below the bottom edge of the utility.



SMALL PIPE OR CABLES



LARGE PIPE OR MULTIPLE DUCTS

Methods of Excavation within the tolerance zone are:

Hand Digging (Pot Holing)

Vacuum Excavation

Hydraulic Excavation

# EXCAVATION 101

- THE MARKINGS

UNDOCUMENTED CONDITIONS:

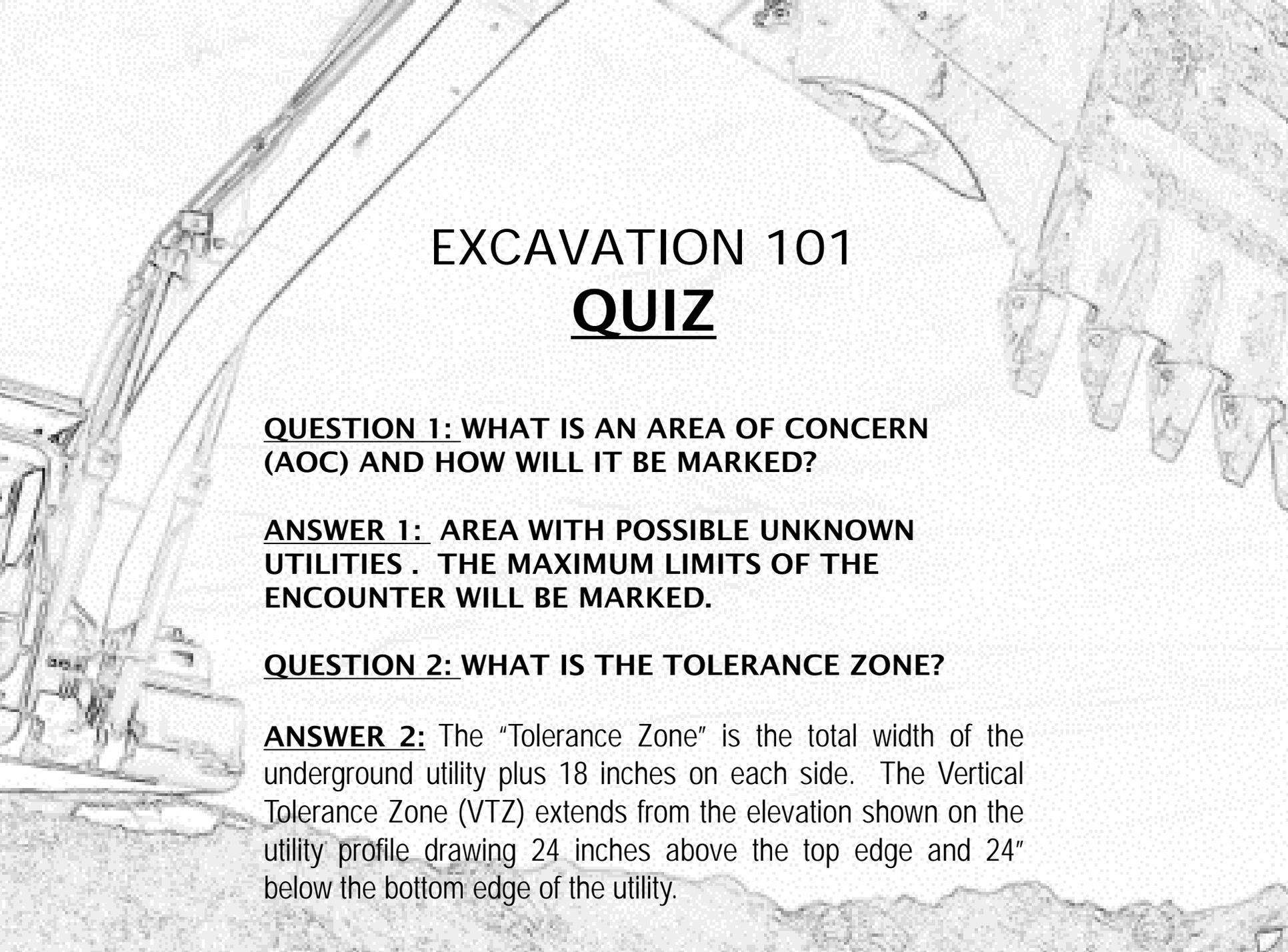
You must notify the Emergency Dispatch and your COR if an unexpected underground utility or structure is found during the activity or if an underground utility or structure is hit or broken during the activity (The requestor will notify the emergency dispatch at 911 if using a NASA internal telephone or if using a cell phone dial 216-433-8888 at Lewis Field or 419-621-3222 at Plum Brook Station.) It is the COR's responsibility to notify SHeD.

**EMERGENCY DISPATCH**

911 (NASA Internal Phone)

216-433-8888 (Lewis Field)

419-621-3222 (Plum Brook)

The background of the slide is a grayscale, high-contrast image of an excavator bucket. The bucket is positioned diagonally, with its tip pointing towards the bottom right corner. The image shows the mechanical details of the bucket, including the teeth and the hydraulic arm. The overall tone is technical and industrial.

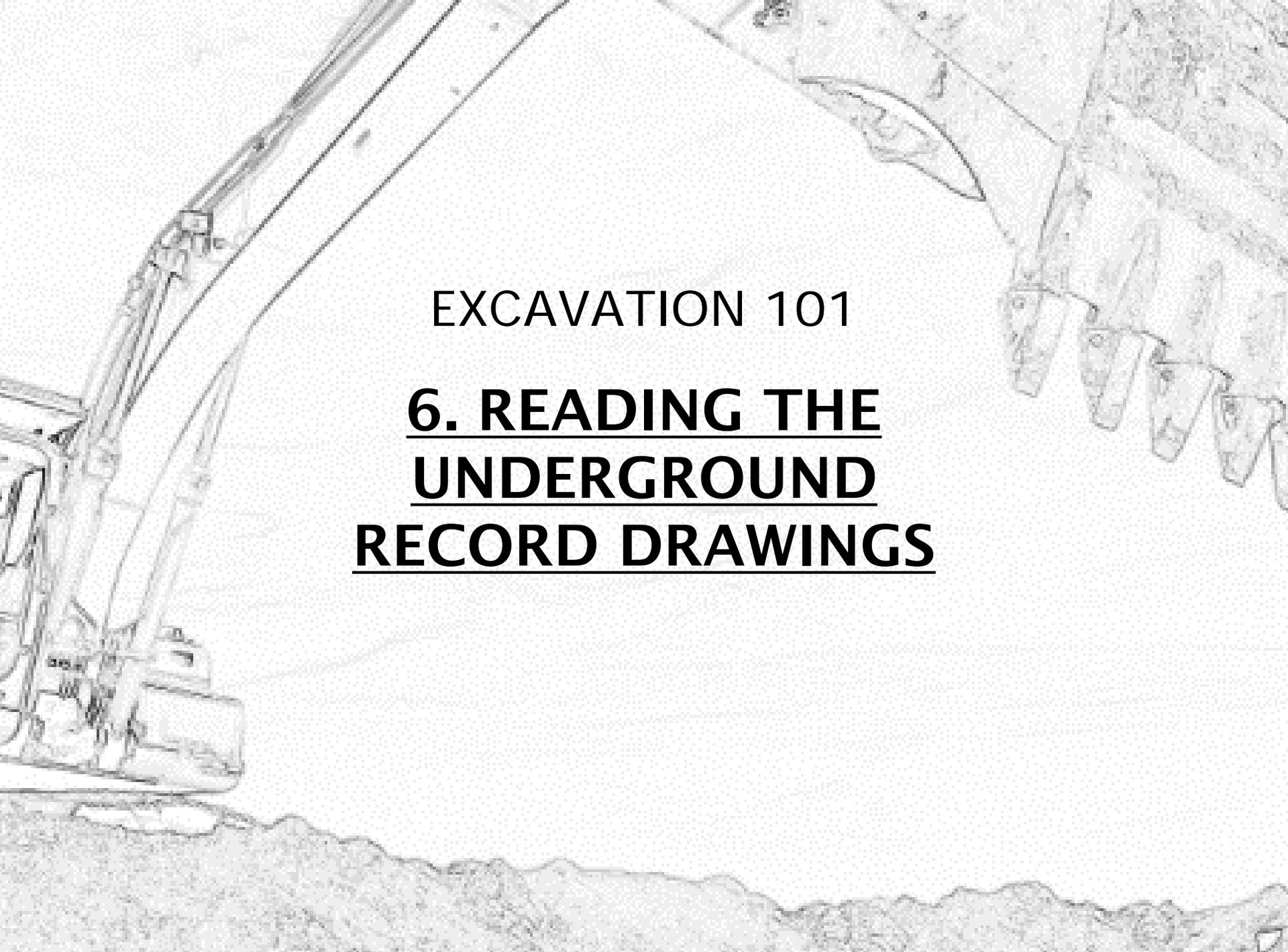
# EXCAVATION 101 QUIZ

**QUESTION 1: WHAT IS AN AREA OF CONCERN (AOC) AND HOW WILL IT BE MARKED?**

**ANSWER 1: AREA WITH POSSIBLE UNKNOWN UTILITIES . THE MAXIMUM LIMITS OF THE ENCOUNTER WILL BE MARKED.**

**QUESTION 2: WHAT IS THE TOLERANCE ZONE?**

**ANSWER 2:** The "Tolerance Zone" is the total width of the underground utility plus 18 inches on each side. The Vertical Tolerance Zone (VTZ) extends from the elevation shown on the utility profile drawing 24 inches above the top edge and 24" below the bottom edge of the utility.

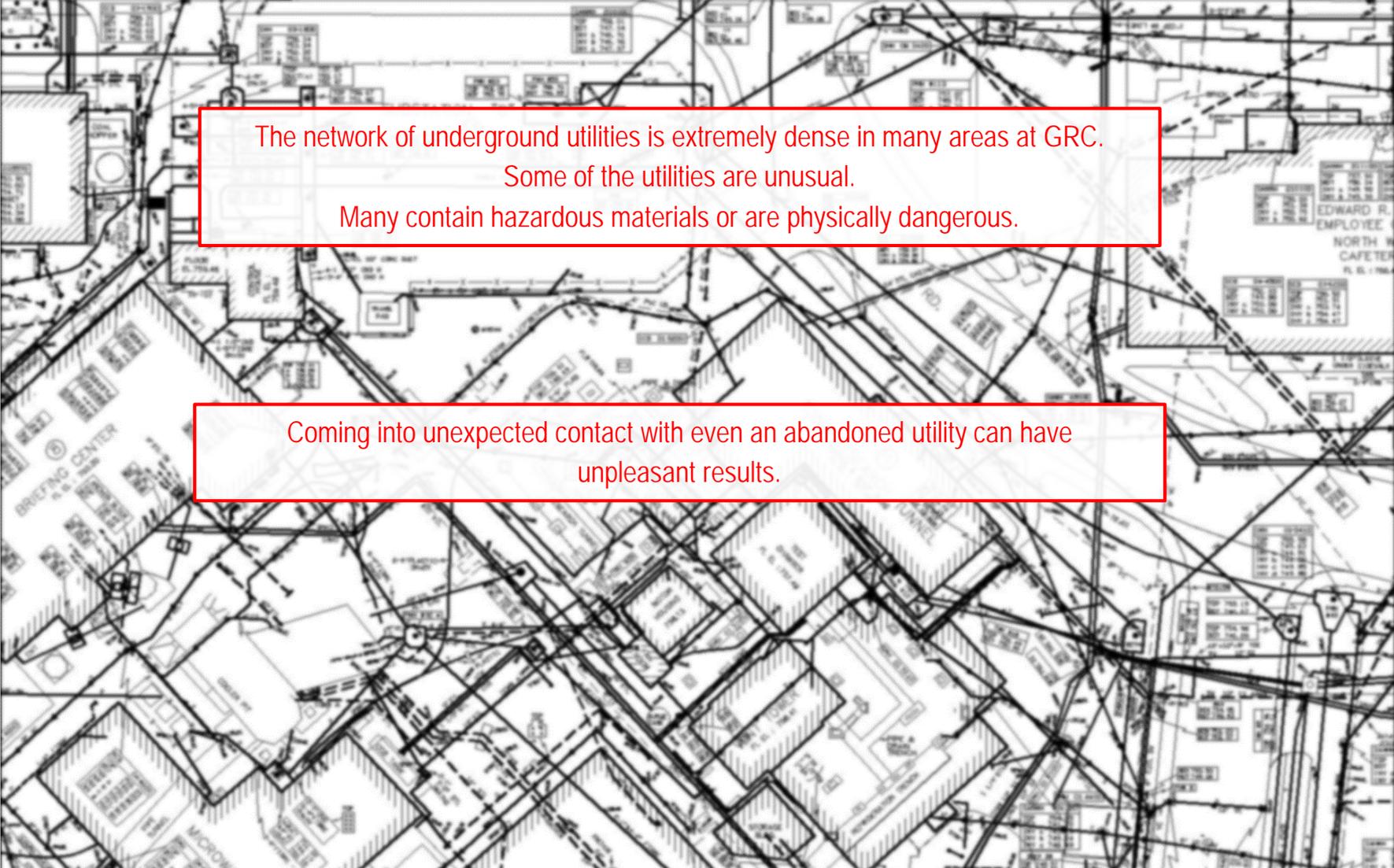
The background of the slide is a technical drawing of an excavator's hydraulic system. It shows a large bucket on the left side, connected to a series of hydraulic cylinders and hoses that extend towards the right. The drawing is rendered in a light, sketchy style, showing the mechanical components and their connections.

EXCAVATION 101

**6. READING THE  
UNDERGROUND  
RECORD DRAWINGS**

# EXCAVATION 101

- READING THE UNDERGROUND RECORD DRAWINGS



The network of underground utilities is extremely dense in many areas at GRC.  
Some of the utilities are unusual.  
Many contain hazardous materials or are physically dangerous.

Coming into unexpected contact with even an abandoned utility can have unpleasant results.

# EXCAVATION 101

## • READING THE UNDERGROUND RECORD DRAWINGS

Rules and Standards for using paper plots of the URDs:

- Scaling a paper drawing should never be done for critical dimensions; even for estimating it is not good practice unless a graphic scale is shown for calibration
- Elevations are always top of utility unless noted otherwise, such as inv. or f.l. (pipe invert or flow line)
- Most utilities are shown by centerline for horizontal location. A single line width can show the location of a single direct buried wire or a 30" dia Combustion Air Line or a 48" wide Power Duct Bank
- A 48" wide duct bank that is perpendicular to a trench will have a crossing distance of 48". At a 45 degree angle to the trench the same duct bank will have a crossing distance of 68"
- Width of some duct banks are determined by the number and diameter of conduit, the estimated space between, and to the edges (3" normal); e.g.:

5" CND-3Hx2V on drawing calls out:

5" Dia. CoNDuit-3Horiz x(by) 2Vert.

H=15"(conduit)+12"(2 spaces+2x3"cover)

H=27"(Width)

V=10"(conduit)+9"(1space+2x3"cover)

V=19"(Height)

- Active Utility Centerlines are shown by a solid line type and labelled by system, material, size and any appropriate known information.
- Abandoned Utility Centerlines are shown by a broken line type, fully labelled with the notation "ABAN"

# EXCAVATION 101

## • READING THE UNDERGROUND RECORD DRAWINGS

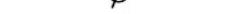
### URD ABBREVIATION TABLE

ABAN	ABANDONED	DI	DUCTILE IRON	IWS	INDUSTRIAL WASTE SEWER	R/W	RIGHT OF WAY
BC	BURIED CABLE	DP	DUAL PURGE	JB	JUNCTION BOX	S	STORM
BLDG	BUILDING	DR	DRAIN	LF	LIQUID FUEL	SA	SERVICE AIR
BM	BENCH MARK	DS	DOWNSPOUT	LPS	LOW PRESSURE STEAM	SAN	SANITARY
BOT	BOTTOM	DW	DOMESTIC WATER	LT	LIGHT	SCGR	STEAM COND GRAVITY RETURN
CB	CATCH BASIN	EL	ELEVATION	MH	MANHOLE	SCPR	STEAM COND PUMPED RETURN
CHWR	CHILLED WATER RETURN	ENTR	ENTRANCE	MON	MONUMENT	ST	STEAM
CHWS	CHILLED WATER SUPPLY	E/P	EDGE OF PAVEMENT	NG	NATURAL GAS	STA	STATION
CI	CAST IRON	FD	FLOOR DRAIN	NIC	NOT IN CONTRACT	STL	STEEL
CICL	CAST IRON CEMENT LINED	FDN	FOUNDATION	P	POWER	T	TELEPHONE
CMP	CORRUGATED METAL PIPE	FH	FIRE HYDRANT	PB	PULL BOX	TRAN	TRANSFORMER
CND	CONDUIT	FL	FLOOR	PC	POINT OF CURVATURE	UD	UNDERDRAIN
CO	CLEAN OUT	FO	FUEL OIL	PERF	PERFORATED	VAC	VACUUM
COMBA	COMBUSTION AIR	FOLQ	FOAM LIQUID	PI	POINT OF INTERSECTION	VB	VALVE BOX
CONC	CONCRETE	FTG	FOOTING	PP	POLYPROPYLENE	VC	VITRIFIED CLAY
CONN	CONNECTION	H	LETTER "H" IN HYDRANT	PT	POINT OF TANGENCY	VERT	VERTICAL
COP	COPPER	HDPE	HIGH DENSITY POLYETHYLENE	PVC	POLYVINYL CHLORIDE	VLV	VALVE
CPTB	CATHODIC PROTECT TEST BOX	HH	HANDHOLE	RC	REINFORCED CONCRETE	WM	WATER METER
CS	CARBON STEEL	HORZ	HORIZONTAL				
CTWR	COOLING TOWER WATER RETURN	HPS	HIGH PRESSURE STEAM				
CTWS	COOLING TOWER WATER SUPPLY	IA	INSTRUMENT AIR				
DG	DEGREES	INST	INSTRUMENT				

# EXCAVATION 101

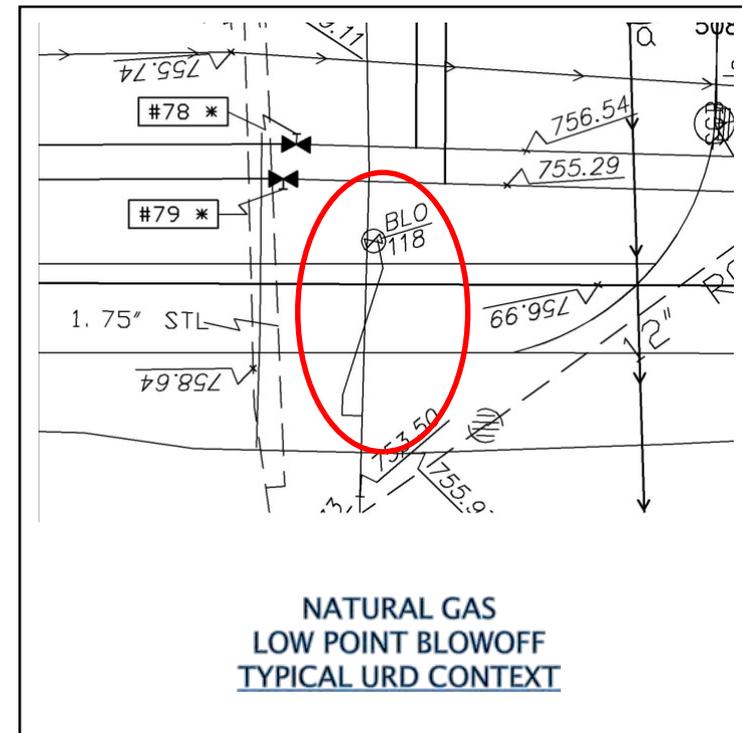
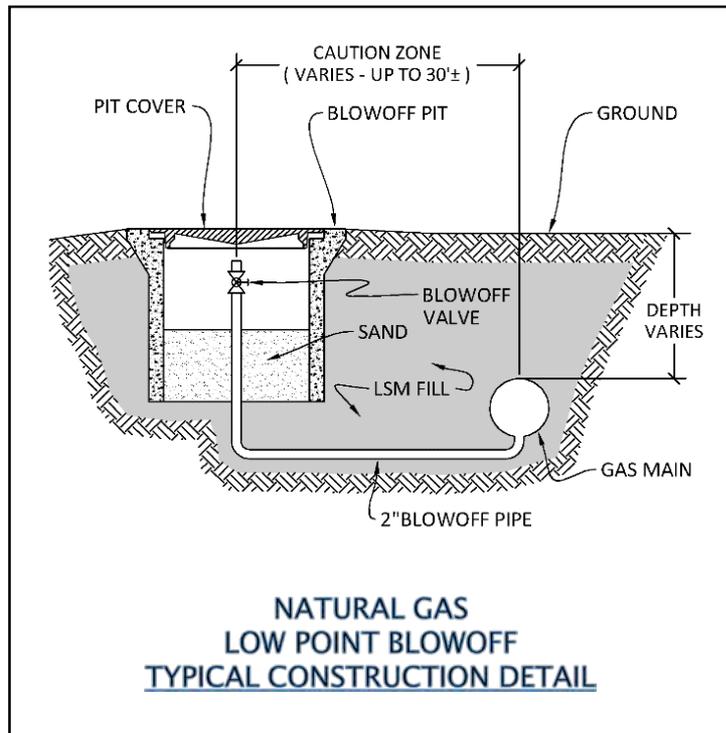
- READING THE UNDERGROUND RECORD DRAWINGS

## URD SYMBOL LEGEND

SYMBOL	DESCRIPTION
	ACTIVE UTILITY LINE
	ABANDONED UTILITY LINE
	GRAVITY LINE w/ FLOW DIRECTION
	DUAL PURGE VALVE (NATURAL GAS)
	BLOWOFF PIT (NATURAL GAS)
	TYPICAL VALVE
	PIPE REDUCER or INCREASER
	PIPE RISER or DROP
	STORM SEWER CURB CATCH BASIN
	STORM STRUCTURE w/ ROUND GRATE
	STORM STRUCTURE w/ SQUARE GRATE
	UTILITY MANHOLE w/ SOLID LID
	POWER POLE
	POWER POLE WITH STREET LIGHT
	STANDARD FIRE HYDRANT
	GRAVITY LINE CLEANOUT
	PIPE CAP OR PLUG
	EXTENT OF KNOWN LOCATION
	GROUNDWATER MONITOR WELL
	CATHODIC PROTECTION TEST BOX
	PUMP OUT FIXTURE
	HEAD WALL-CULVERT- END WALL

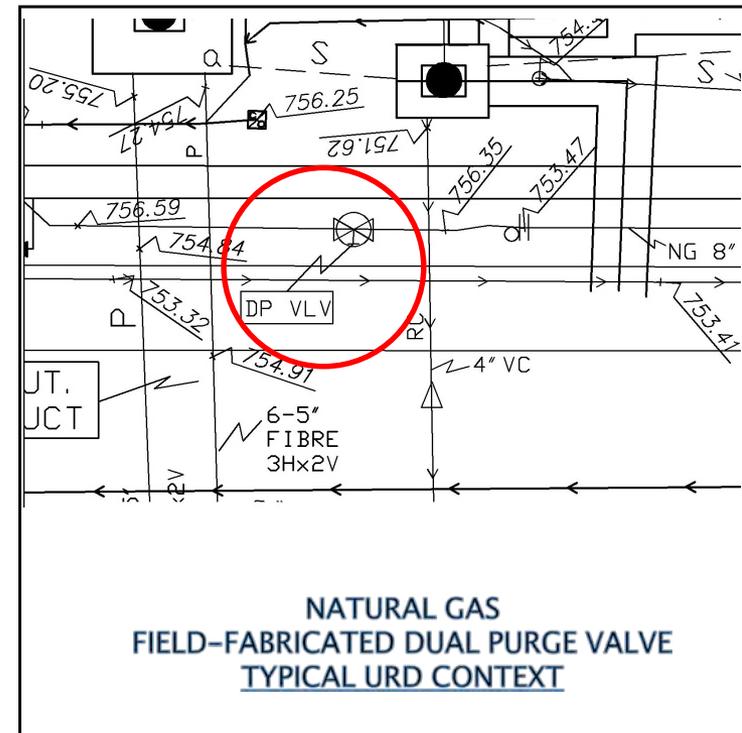
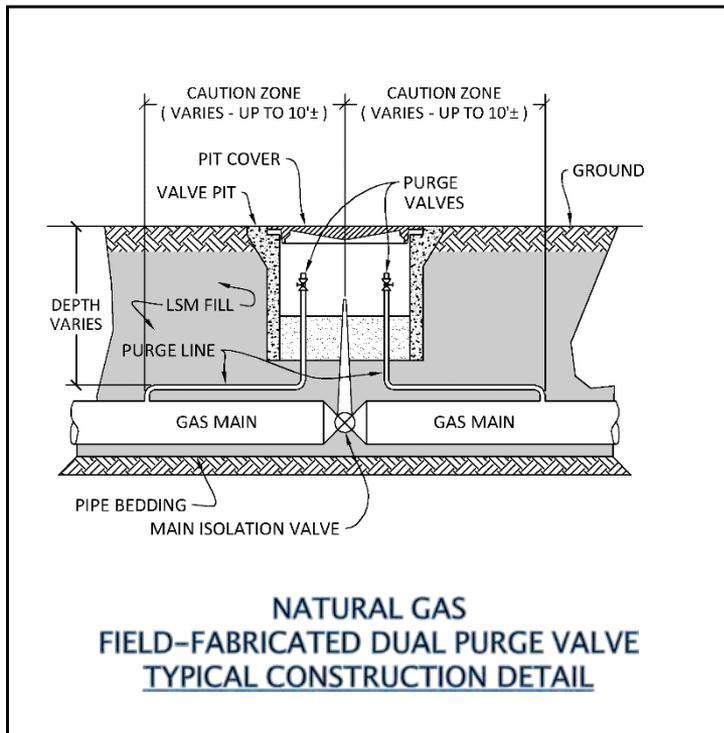
# EXCAVATION 101

- READING THE UNDERGROUND RECORD DRAWINGS



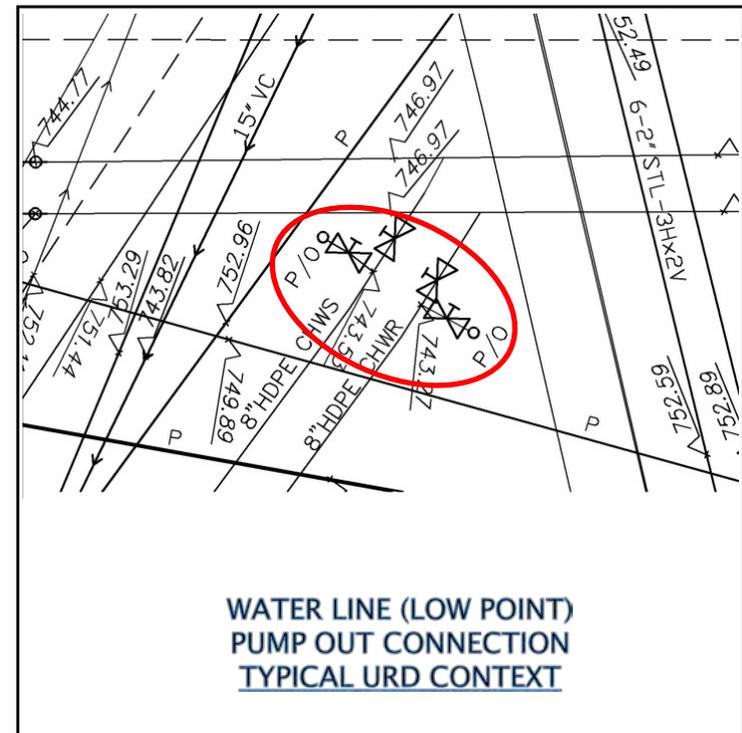
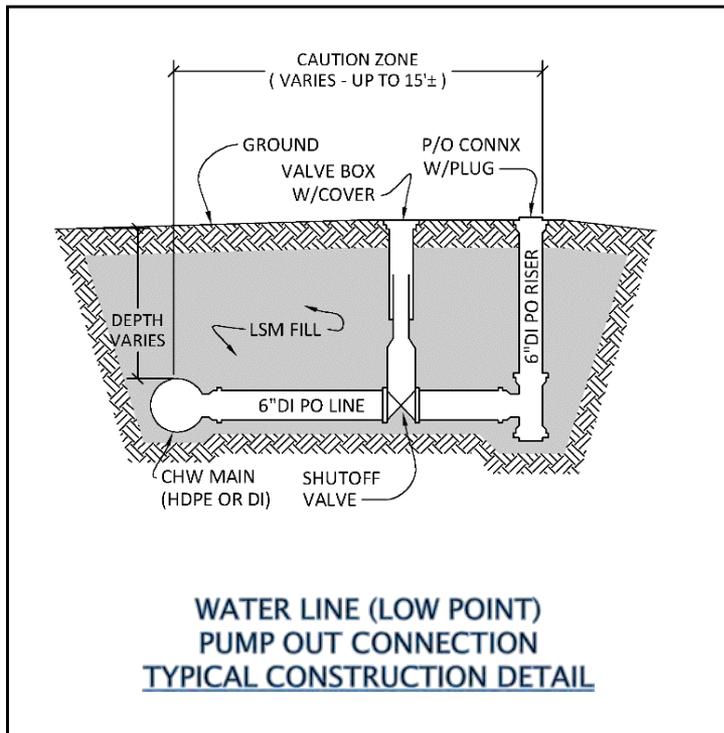
# EXCAVATION 101

- READING THE UNDERGROUND RECORD DRAWINGS



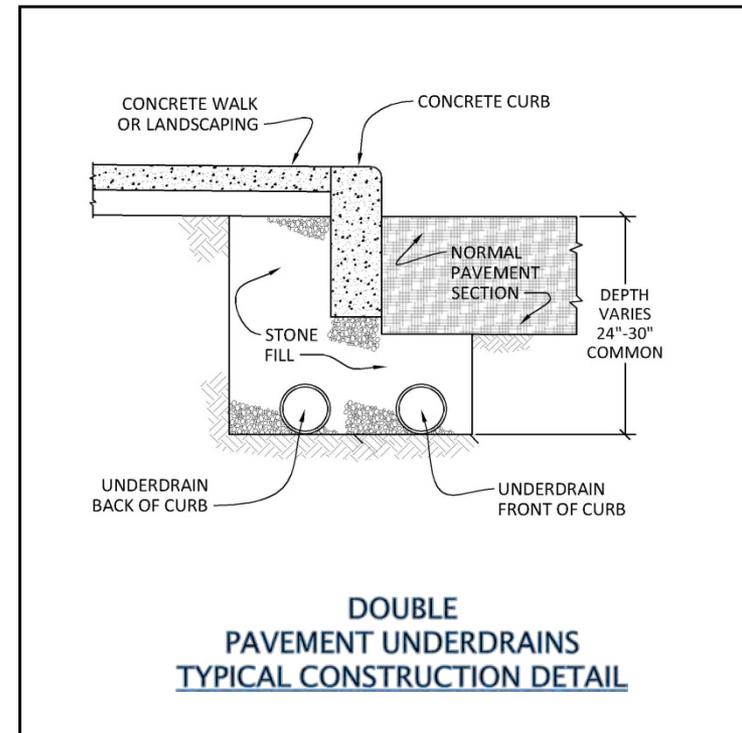
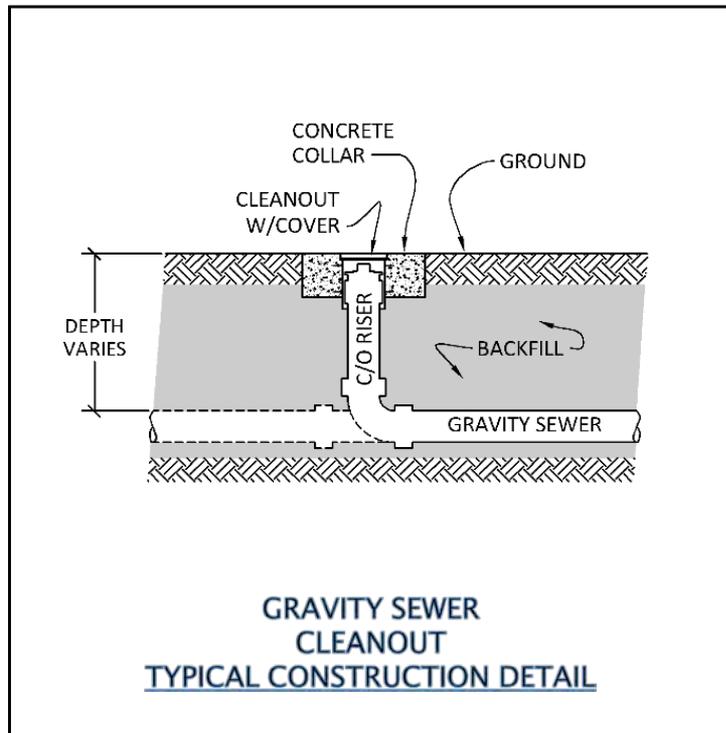
# EXCAVATION 101

- READING THE UNDERGROUND RECORD DRAWINGS



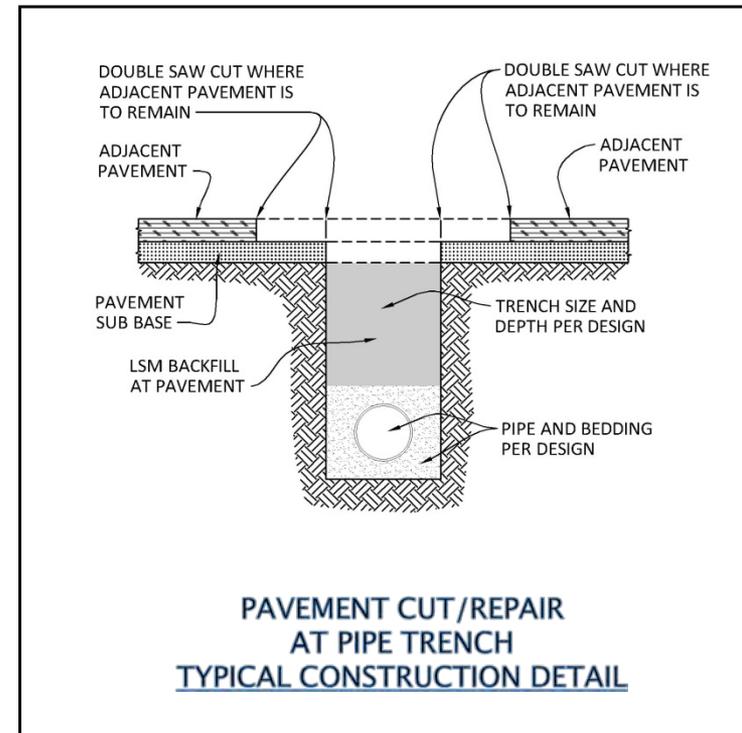
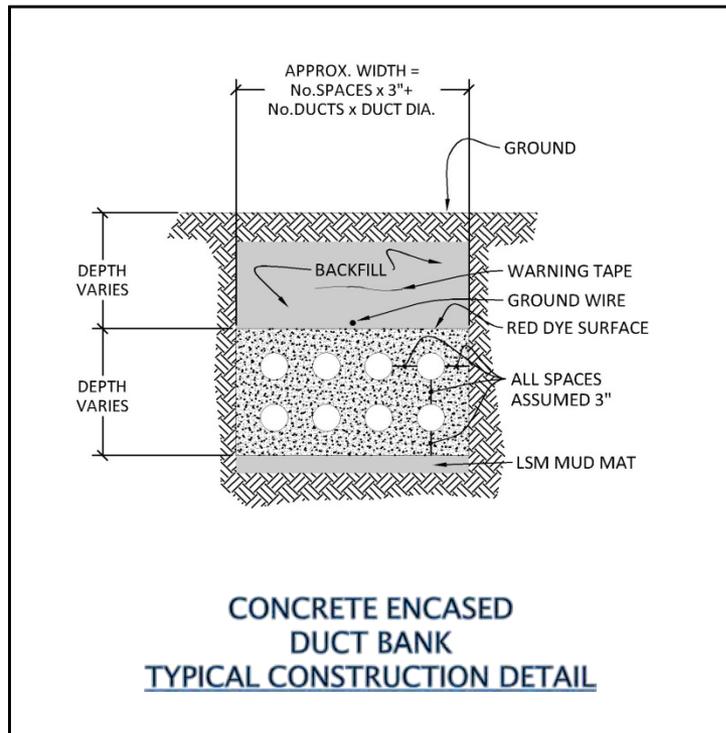
# EXCAVATION 101

- READING THE UNDERGROUND RECORD DRAWINGS



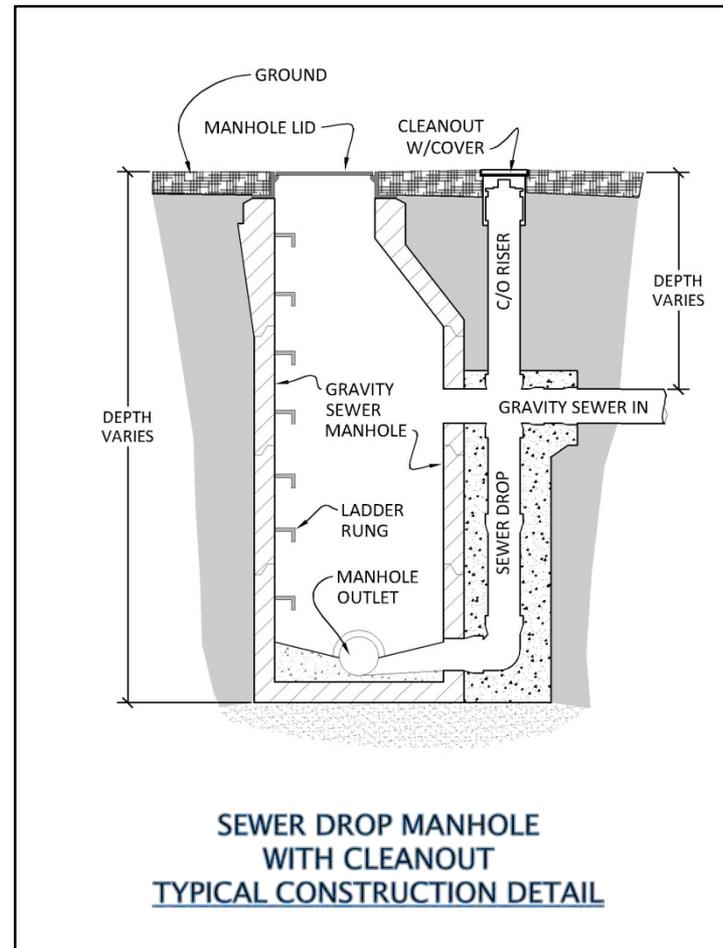
# EXCAVATION 101

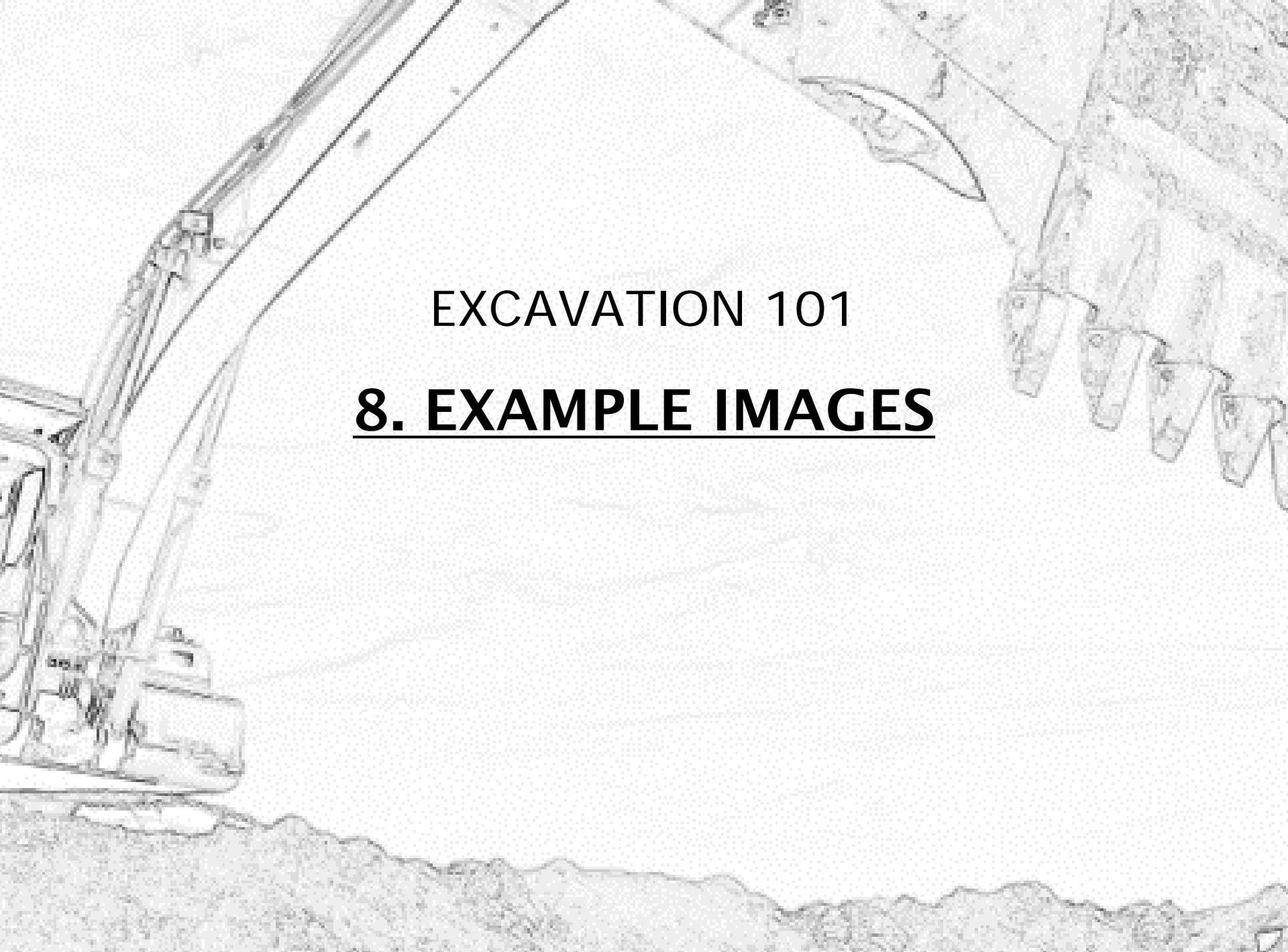
- READING THE UNDERGROUND RECORD DRAWINGS



# EXCAVATION 101

- READING THE UNDERGROUND RECORD DRAWINGS





EXCAVATION 101

**8. EXAMPLE IMAGES**



2014/07/23 09:47



2014/07/23 09:48



10/27/2009 14:26



2014/06/10 12:43

# OPTION 01

REMOVE & REPLACE PVMT FOR UTILITY TRENCH IF OPTION 01 IN NOT ACCEPTED

**OPTION 01**  
SEE STORM PROFILE 'D'  
SHEET C-113

# BASE BID

SEE UG ELEC LINE 1  
PROFILE SHEET C-114

SEE SEWER  
NOTE 8  
(TYP.)

SEE STORM PROFILE 'A'  
SHEET C-113

SEE PO  
PROFILE

SEE UG ELEC  
LINE 2 PROFILE  
SHEET C-114

SANMH 208690	
TOP	759.56
BOT	752.40
INV a	751.50
INV b	751.71
INV c	751.68

PROVIDE HANDHOLE  
FOR FUTURE ELECTRIC  
CAR CHARGING

CORE DRILL EX.  
MH. CONNECT W/  
WATERTIGHT  
RUBBER BOOT AT  
INV 754.54

LOWER WATER AS  
REQUIRED TO MAINTAIN 12"  
VERTICAL CLEARANCE

CORE DRILL & CONNECT  
TO EXIST W/ FLEXIBLE  
WATER TIGHT BOOT AT  
INV 752.50

EX ST  
MH

SMH 06-5300	
TOP	759.03
BOT	752.00
INV a	752.85
INV b	756.00
INV c	752.80

SMH 06-5200	
TOP	759.26
BOT	753.35
INV a	752.66
INV b	755.56
INV c	756.51
INV d	752.51
INV e	756.56

CB 3

SEE SAN PROFILE  
SHEET C-113

CONNECT TO EXIST 15"  
STORM PIPE W/ FLEXIBLE  
WATER TIGHT CONNECTION  
±753.16

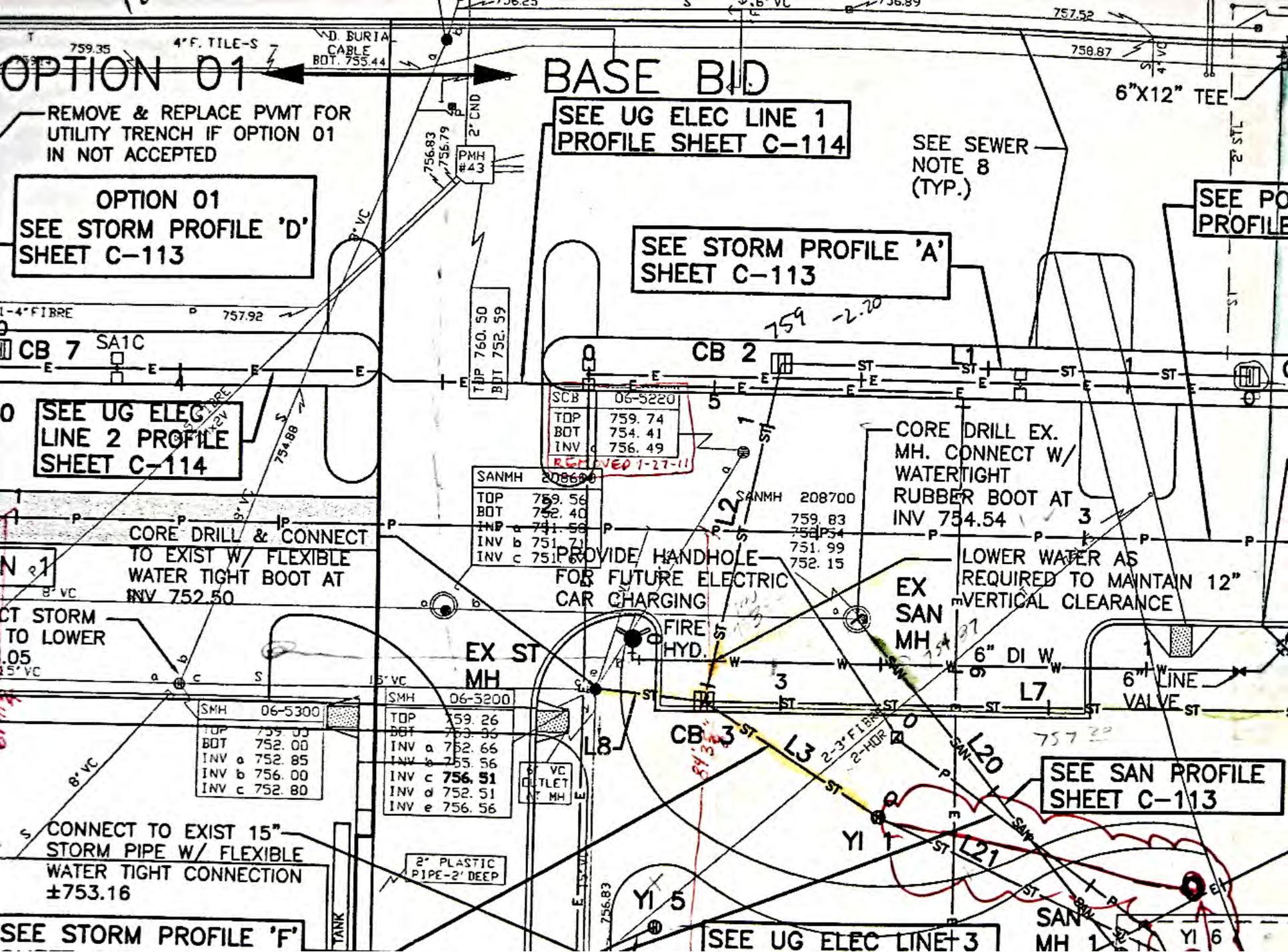
SEE STORM PROFILE 'F'

SEE UG ELEC LINE 3

2" PLASTIC  
PIPE-2' DEEP

SAN  
MH 1

YI 6





**PIPING MATERIAL SCHEDULE**

SERVICE	MATERIAL	SIZE	PIPE
WATER	ALL SIZES	DUCTILE IRON PIPE	CLASS 200
NATURAL GAS	ALL SIZES	DUCTILE IRON PIPE	CLASS 200
NATURAL GAS	ALL SIZES	DUCTILE IRON PIPE	CLASS 200
SEWER	ALL SIZES	DUCTILE IRON PIPE	CLASS 200
STORM	ALL SIZES	DUCTILE IRON PIPE	CLASS 200
SHIELDED WATER	ALL SIZES	DUCTILE IRON PIPE	CLASS 200

**NOTES**

- CONTRACTOR TO CONTACT MASA SURVEYORS FOR EXISTING UTILITIES BEFORE TRACING. THE DISCREPANCY PERMIT IS REQUIRED PRIOR TO STARTING ANY WORK.
- CONTRACTOR TO HAVE ALL STAMPS, PERMITS, AND PROFESSIONAL ENGINEER'S SIGNATURES ON ALL DRAWINGS.
- SEE SHEET C-110 FOR GENERAL NOTES.
- RESTRAINT DEVICE FOR CHILLED WATER. THESE DEVICES SHALL BE USED ON ALL CHILLED WATER PIPING. THE DEVICES SHALL MEET THE REQUIREMENTS OF ASTM A1321 OR AS SPECIFIED.

**LEGEND**

- PROPOSED CHWS
- PROPOSED CHWR
- PROPOSED UNDERGROUND ELECTRIC
- PROPOSED POWER
- PROPOSED STRUCTURE
- PROPOSED PLAN FCV
- PROPOSED
- PROPOSED

**STORM UTILITY STRUCTURE SCHE**

STRUCTURE NO.	STRUCTURE TYPE	RIM	INVERT
EX CB	CATCH BASIN	758.92	756.81-12'3"
EX ST MH	MANHOLE	759.26	752.50-15'5"
CB 1	CATCH BASIN	760.00	756.42-12'
CB 2	CATCH BASIN	759.00	754.48-12'
CB 3	CATCH BASIN	759.00	752.92-11'
CB 4	CATCH BASIN	759.00	756.23-11'
CB 5	CATCH BASIN	760.50	758.89-1'
CB 6	CATCH BASIN	759.80	757.76
CB 7	CATCH BASIN	760.00	757.00
CB 12	CATCH BASIN	758.30	755.00
CB 13	CATCH BASIN	760.30	757.00
CB 14	CATCH BASIN	759.70	752.10
YD 1	10" YARD DRAIN	758.87	757.87
YD 2	18" YARD DRAIN	760.80	757.80
YD 4	10" YARD DRAIN	760.00	757.00
YD 5	10" YARD DRAIN	759.75	757.75
YD 6	10" YARD DRAIN	760.93	757.93
WQ 1	WATER QUALITY UNIT	760.04	757.04

**SANITARY**

EX SAN MH	MANHOLE	759.1
SAN MH 1	MANHOLE	760.0

**STORM UTILITY LINE**

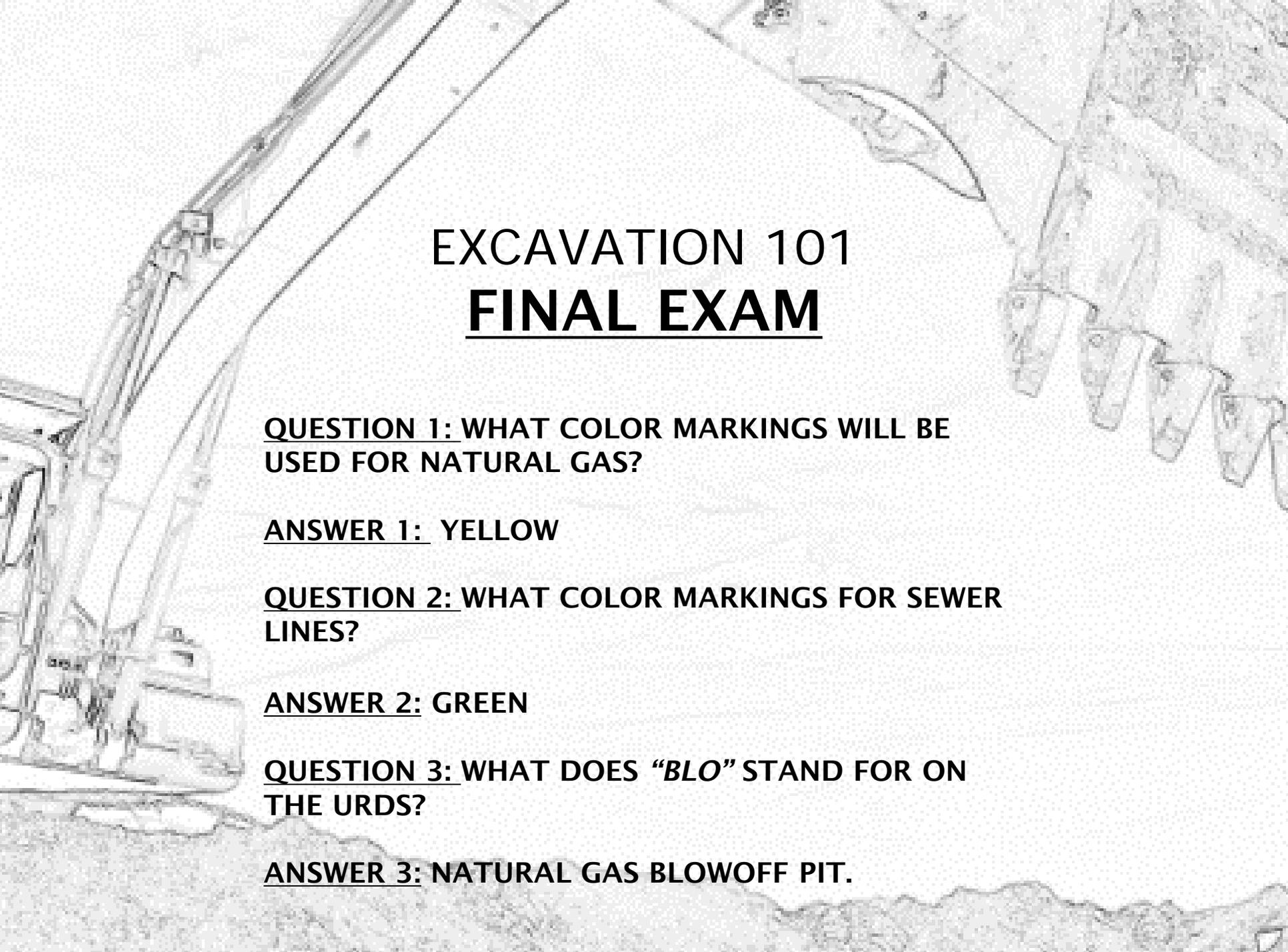
LINE NO.	UPSTREAM STRUCTURE	DOWNSTREAM STRUCTURE
L1	CB 1	CB 2
L2	CB 2	CB 3
L3	YD 1	CB 3
L4	FROM BLDG	CB 4
L5	CB 4	YD 1
L6	YD 2	CB 5
L7	CB 5	CB 3
L8	CB 6	EX
L10	CB 7	
L14	YD 4	
L15	CB 12	
L16	FROM BLDG	

- KEY NOTES**
- EXISTING TELECOMMUNICATION MANHOLE TO REMAIN; PROTECT AS REQUIRED
  - EXISTING DUCT BANKS TO REMAIN; PROTECT AS REQUIRED
  - CONNECT TO EXISTING GAS LINE
  - EXISTING UTILITY TO REMAIN; PROTECT AS REQUIRED

09/18/2012 08:48



08/16/2012 11:42

The background of the slide features a grayscale image of an excavator bucket on the left side, and a utility map on the right side. The map shows various lines and symbols representing underground utilities. The text is overlaid on this background.

# EXCAVATION 101

## FINAL EXAM

QUESTION 1: WHAT COLOR MARKINGS WILL BE USED FOR NATURAL GAS?

ANSWER 1: YELLOW

QUESTION 2: WHAT COLOR MARKINGS FOR SEWER LINES?

ANSWER 2: GREEN

QUESTION 3: WHAT DOES “*BLO*” STAND FOR ON THE URDS?

ANSWER 3: NATURAL GAS BLOWOFF PIT.